SRI PROJECT NO. I/2688

ACC. NO. 4524

REPORT NO.

COPY NO. 53, 54

CLIENT Sylvannia Electronic Systems
Waltham, Mass.

CONTRACT NO.

TITLE A STUDY OF THE COMMERCIAL MARKET FOR THE MOBIDIC COMPUTER

AUTHOR A.E. Lee, W.A. Cubberley, C.P. Bourne

DATE ISSUED 3/59

CLASSIFICATION SRI Confidential

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SRI PROJECT NO. I-2784

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REPORT NO.

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CLIENT International Computers and Tabulators, Ltd.
London, England

CONTRACT NO.

TITLE AN ASSESSMENT OF THE ICT TYPE 1301 AND 1400 COMPUTER SYSTEMS FOR COMMERCIAL AND INDUSTRIAL MARKETS

AUTHOR D.M. Finnigan, C.P. Bourne, L. Fein

DATE ISSUED 12/59

CLASSIFICATION SRI Confidential

~~LAB NOTEBOOK NO.~~ 151 pages

11a

KEYBOARD-TO-TAPE INPUT SYSTEMS
Modern Data
Vol. 2, No. 12, Dec. 1969, pp. 68-77

Feb
1959 – June
STEP Project

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Charts summarizing the major characteristics of units available from all 33 manufacturers are also included in Tables 1 and 2. Table 1 covers stand-alone machines and Table 2 covers shared processor systems. [Table 1 provides the following characteristics: model numbers, computer compatability, record length, operating modes, programable, type of display, hard copy output, communications, data pooling, approximate purchase price, and approximate monthly rental price for equipment manufactured by Burroughs, Communitype, Computer Access Systems, Cybercom, Data Action, Data Instrument Co., Dicon, Facit-Odhner (Model 6202), Honeywell, IBM, Keymatic (Model 1000), MAI, Mohawk Data Sciences, NCR, Potter Instrument Company, R-J Communication Products, Sangamo, Sycor, Tally, Ty-Core, Vanguard and Viatron.]

Burroughs Corp., Detroit, Mich....Three Series N models offer tape packing densities of 200, 556, or 800 bpi....

CI Realtronics, Inc., N.Y., N.Y....R1 System, consists of data keyboards, a central controller containing intermediate storage disks, a supervisory control console, and central magnetic tape stations. Up to 32 data keyboards may be used....

...

Computer Entry Systems Corp., Silver Spring, Md....Series 6000 is a shared processor, 6-terminal system....

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Consolidated Computer Services, Ltd., Toronto, Canada...This company offers a system called Key-edit that consists of a powerful central processor, a high-speed magnetic drum for temporary storage, either a magnetic tape drive or disk drive for output, and individual solid state keyboards for input. Up to 32 keyboard terminals are connected on-line to the central processor and can be used for entering or verifying data files....

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Extract

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...

Keyboard-To-Tape Input Systems

Cybercom Corp., Sunnyvale, Cal....Mark I System consists of two units--a key encoder and a cartridge converter. Data is first entered through a keyboard onto 1/4 inch magnetic tape and later transcribed onto 1/2 inch computer tape. One converter will support up to 15 key encoders....

...

Data Action, Minn., Minn....Model 150 records data directly on magnetic tape at the point of origin or at a central keying location....

The cartridge tape is completely compatible with IBM 360 systems....

...

Data Instruments Co., Sepulveda, Cal....Dataplex System is a completely integrated business data gathering system that captures information from any business environment and prepared this information for a computer in a fully-formatted computer language....

...

The Dataplex Processor receives all cassettes created by terminals in various remotely-located departments. One processor, converting raw cassette data into 7- to 9-channel computer-useable form, can handle hundreds of terminals. The processor consists of an automatic cassette reader, a small computer, and input/output writer, and a computer tape drive.

...

Data Synectics Corp., Burlington, Mass....new company whose founder, Charles W. Adams...The company is about to introduce (or perhaps already has introduced) a multi-terminal, computer-controlled key-to-tape system called the Magnescriber. Up to 30 terminals can be serviced by the pre-programmed computer....

Dicom Industries, Inc., Sunnyvale, Cal....The Dicom 344 is a low-cost three-deck cassette recording system capable of operating off-line or on-line. In the on-line mode, the Dicom 344 operates with a computer with data being transferred at five hundred characters per second. In the off-line mode, a buffer is used, allowing data to be entered asynchronously then placed on tape in a block synchronous operation....

...

General Computer Systems, Inc., Dallas, Texas...Data/Tape 2100 System operates under control of Computer Automation's 816 computer....From 8 to 31 keyboard printers can be on-line...

...

Inforex, Inc., Burlington, Mass....Intelligent Key Entry System enables data to be transcribed to an intermediate storage area when pooled to magnetic tape....Up to 8 keystations which can enter, verify, and perform supervisory functions, are attached to a control unit....

...

Penta Computer Associates, Inc., N. Y., N. Y....KeyLogic system is a multiple-station, direct data entry system that allows user-oriented program formats. The system functions with up to 64 complete terminals and can accomodate a minimum of 32 logically different jobs....

...

R-J Communication Products, Inc., Phoenix, Ariz....DS-10 system consists of a heavy-duty IBM electric typewriter, either the fixed-carriage Selectric type or the moveable-carriage Model B type electrically connected to a desk-top magnetic tape recorder.

...

Systems Engineering Labs, Ft. Lauderdale, Fla....KeyTran System provides data entry under programmed control of a small, sub-microsecond computer. The system includes full application software and a supervisor's console and enters information simultaneously from up to 48 keyboard terminals onto a disk....

TEC, Inc., Eden Prairie, Minn....This company, formerly known as Transistor Electronics and as a manufacturer of panel displays, pushbutton switches, and CRT displays, has just developed a multi-station key-to-tape shared processor system. The complete system, which includes up to 32 keyboard stations sharing a TEC 520 TCP processor will be over 80% manufactured by TEC.

...

[Available: IRC Source File]

3/3

CONVERSION OF RETROSPECTIVE CATALOG RECORDS TO MACHINE-READABLE FORM. A STUDY OF THE FEASIBILITY OF A NATIONAL BIBLIOGRAPHIC SERVICE. Library of Congress, RECON Working Task Force, Washington, D. C., 1969, 230 pp.

Extract of Book Review
Source: Program-News of Computers in Libraries, Vol. 3, Nos. 3, 4, Nov. 1969, pp. 165-167
Reviewer: Peter Brown, Bodleian Library

...

...There is much to be admired in the Library of Congress practice of publishing without delay the reports of its groups and task forces. The RECON (Retrospective Conversion) Study originated from a Library of Congress proposal and was supported by the Council on Library Resources. An advisory committee of librarians gave guidance and the study itself was carried out by a working task force composed of librarians and systems analysts representing different types of libraries. The idea for the study and the Library of Congress proposal came from Henriette Avram; she has been Chairman of the task force and is now Director of the pilot project that has resulted from the study.

...The report...deals with many aspects of retrospective conversion:

1. THE USES OF CONVERTED BIBLIOGRAPHIC DATA. Although this is not investigated in detail, aspects of both library processing and retrieval for library users are considered.

2. THE DATA-BASE FROM WHICH CONVERSION MIGHT BE MADE AND THE POSSIBLE STRATEGIES FOR CARRYING OUT THE CONVERSION. The argument is made for using the Library of Congress Catalogue as the largest and most consistent source for the bibliographic records to be converted, just as in Great Britain the natural source for conversion would be the British Museum Catalogue entries....

SUBJECT: Real-Time Computer Aid for Human Information Manipulation

copy to RADC / CB project file (2)

REFERENCE: RAW-64-579 -- From PSA 16 September 1963

TO: Directorate of Procurement
Rome Air Development Center
Attn: RAKS
Griffiss Air Force Base, New York 13442

1.0 Stanford Research Institute

Stanford Research Institute is a not-for-profit corporation chartered by the State of California. The Institute was founded in November, 1946 by action of the Trustees of Stanford University, and many members of the Board of Directors of the Institute are also on the Board of Trustees of the University, although there is no operational connection between the two organizations. Headquarters and principal laboratories of the Institute are at Menlo Park, California. Regional Office locations include New York City, Detroit, Wash. D.C., Pasadena, Calif., Tokyo, Japan, and Zurich, Switzerland.

SRI is one of the largest research institutes, with excellent facilities, and a highly competent research staff with broad interests, training, and experience in the physical sciences, life sciences, engineering, and economics. The Institute has a total staff of 2300 persons, of whom over 1,200 are in technical and professional categories. Advance degrees are held by 600 staff members; of these 275 hold Ph.D. or equivalent degrees. The Institute has Top Secret clearance under Western Contract Management Region (RWIP), United States Air Force, Mira Loma Air Force Station, Mira Loma, Calif.

2.0 Qualifications and Facilities

2.1 Personnel: Eight professionals are engaged full time in original and coordinated research that is directly relevant to the subject research. Nine other professionals are providing part-time backup service in engineering, psychology, content analysis, and systems analysis.

2.2 Special Facilities: (A) Experimental laboratory equipped with a character generator and cathode-ray-tube display incorporated into a flexible console arrangement to provide real-time man-computer interaction. A CDC 160A computer to provide instantaneous real-time service for the smaller service processes (B) a telephone tie-line connecting this computer as a satellite to the Q32 computer in the Command Laboratory (an ARPA-supported activity)at Systems Development Corp., in Santa Monica. The Q32 is a fast computer of the SAGE class, with 48-bit word length, 65-thousand-word core memory, 500,000 words of high-speed drum storage, 18 tape transports, that is to be operated in a time-sharing mode to give service to a number of satellite computers, display consoles, and teletypewrite stations. It's storage is to be increased next year with the addition of a high-transfer-rate disk file and words of core.

2.3 Objectivity, since Stanford Research Institute is a not-for profit organization, does not hold patents, and it is not in manufacturing nor sales.

STEP

The objectives and method of approach for this project also are a direct outgrowth of the AFOSR-sponsored study. The project began in July, 1963, and proceeds at a $2\frac{1}{2}$ to 3-man level. Dealing only with software and system development (using hardware and basic software of the ARPA project), this project concentrates on improving the management of information involved in minute-by-minute, day-by-day and month-by-month problem-solving activity of a computer programmer and of a research group. The developments of this project will be used and evaluated not only by programmers within the ARPA-project programmer-aid system (and hence by our own researchers in their programming activity), but by the growing list of researchers (of section 2.1) in our coordinated augmented-human-intellect program for managing their individual, group, and external-source working information. Again, improved management is pursued by integrating real-time computer aids with new language and data structures, and new methods and procedures, within a coordinated working system.

3.2 Large Information Processing Systems

STEP

~~describe~~ references a 9/16/1963 document

3.21 The Institute designed for the Air Force (Air Technical Intelligence Center), a comprehensive system for the systematic acquisition, abstracting, translating, dissemination, review, storage, and retrieval of a significant segment of the open-source foreign scientific literature. During the course of this project a comprehensive review was made of the operation and techniques of several of the largest technical information files maintained by the Air Force and other government agencies.

3.22 Another project which was completed after a two-year effort was the design and implementation of a complete data-handling system for an aerial reconnaissance project (ULD-1 Electronic Recon System - Contract AF 33(604)17231. This effort included system studies, computer selection, installation planning, program writing, and assistance with the final system test. For this project, a large data processing system was installed at the Institute for the programing and testing effort, and subsequently delivered to the client as a complete, operating system. Some special-purpose equipment such as magnetic tape converters, and special man-machine operator consoles were also developed as part of this program.

3.3 Miscellaneous Projects Related to Large Information Processing Systems.

Several related projects have been conducted by the Institute in various phases of the technical information problems, both in gross and specialized aspects of data handling, storage, and retrieval.

copy a (RADC) CIS project files (6)
STEP

SUBJECT: Engineering Services for the Design of a System for Searching and Extracting Information

REFERENCE: E-4-109, from PSA 3470, 17 January 1964

TO: Procurement Division
Rome Air Development Center
Attn: EMKS
Griffis AFB, N.Y. 13442

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SRI is one of the largest research institutes, with excellent facilities, and a highly competent research staff with broad interests, training, and experience in the physical sciences, life sciences, engineering, and economics. The Institute has a total staff of 2368 persons, of whom over 1300 are in technical and professional categories. Advance degrees are held by 600 staff members; of these 323 hold Ph.D. or equivalent degrees. The Institute has Top Secret clearance under Western Contract Management Region (RWIP), United States Air Force, Mira Loma Air Force Station, Mira Loma, California.

I QUALIFICATIONS AND FACILITIES

SRI has considerable experience in the design and evaluation of large information systems. The Institute maintains an up-to-date awareness of problems in the distribution and use of scientific and technical information, as well as the research being done on these problems. SRI itself has performed some studies of information resources and the problems of scientific and technical information. SRI currently operates one of the AEC Depositories and maintains its own technical report collection.

We believe that the independent nature of the Institute lends further strength to our capability in system design and evaluation; we do not produce commercial equipment, nor are we in any way allied with a particular manufacturer of data-handling equipment. At the same time, our direct contact with many manufacturers and other research organizations ensures our awareness of their progress in information-handling and related fields. Rapport with manufacturers and possession of in-house systems engineering talent have allowed us to carry out more efficiently all the phases of information-handling system implementation, from initial problem definition through design and analysis, equipment selection, detailed programming and installation, to final user acçeptance-testing.

information problems of the U. S. biomedical researchers. One member of the SRI staff has been an active member of this study group. This project has been concerned primarily with determining the nature of the information problems of biomedical researchers; determining what sources and channels of information are available, and what their limitations are; and what improvements might be considered on a local and national scale to improve the information services and scientist-to-scientist communication.

2. A Preliminary Study of the Requirements, Criteria, and Measures of Performance of Information Storage and Retrieval Systems

A preliminary study was made for the National Science Foundation of the requirements, criteria, and measures of performance of information storage and retrieval systems. Specifically, the objectives were: (1) to develop a methodology for determining user's information requirements; (2) to obtain specific data about the information requirements of a particular community of users; (3) to develop a preliminary set of criteria and a procedure that could be applied to existing information retrieval systems in order to reach tentative conclusions about the desirability of such systems; (4) to develop measures of system performances; and (5) to develop plans for a research program for the longer-range development of more basic and exhaustive criteria and methods for the assessment of alternative systems and procedures.

~~1963?~~ 1959? this references a 17 Jan 64 document

3. Technical Assistance in Implementation of the STEP Program

As a systematic means of reviewing a selected portion of this literature--and of separating important material from unimportant material--the Scientific Technical Exploitation Program (STEP) was established. SRI contracted with the Air Technical Intelligence Center (ATIC) to provide specific guidance on the immediate implementation of STEP and to give technical assistance to ATIC in the preparation of descriptive specifications of a semi-automated system for the entire STEP program.

The general objective was to develop a system by which a continuous scrutiny of Soviet Technical and scientific literature would provide timely and improved technical information about the Soviet technical potential, as well as providing valuable information to the R&D community, and aid in the proper guidance of Air Force research and development programs.

4. MIRF

Under Air Force sponsorship, the Institute is currently studying a special approach to the problem of implementing and using very large files of information. Progress is being made on the hardware and organization design of a Multiple Instantaneous Response File (MIRF) for information retrieval. This particular file device differs from other types of memories in these respects: in response to a question, all the contents of the entire file are searched simultaneously, rather than in sequential fashion, to select those file items that satisfy the search request; all of the answers are provided in a fraction of a second; and provision is made for handling multiple simultaneous answers to the same question. This type of device would ultimately permit a user to pose a question to a file of a million or more items and obtain the answer essentially instantaneously. The logical and

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The Systems Engineerin g Laboratory of the Engineering Sciences Division is engaged in the analysis, design, and evaluation of large-scale information systems. Its programs have both an applied and a basic research component. The applied activities result in the generation of system designs in response to the specific needs of a client. The basic research activities are directly concerned with the development of improved analysis and design techniques. The work maintains a strong multi-disciplinary character. On the one hand, detailed engineering knowledge is required of the current and projected state-of-the-art for computer, communications, and control equipment. At the same time, considerable skill is required in the application of those tools that provide insight into the properties of large-scale systems--queuing theory, linear programming, information theory, modeling, graph theory, simulation, and optimization methods.

Members of this Laboratory have participated in the design of a number of large-scale systems, including a nationwide airline space-reservation system interconnecting automatic data processors and agents set in a complex communication pattern; a nationwide system for processing and disbursing commercial bank checks; a comprehensive facility for the reduction and analysis of electronic reconnaissance data; an electronically instrumented system for automatically evaluating the combat effectiveness of mobile military units; a very large memory for information retrieval problems; and a system for processing graphic information (pattern recognition) with digital computer techniques. Most recently, the members of the Laboratory have led the design effort on the Nimbus weather satellite data-handling system.

General Facilities

Extensive facilities and equipment are available to support the diversified requirements of multi-disciplinary research and development projects.

Special Facilities

Experimental laboratory equipped with a character generator and cathode-ray-tube display incorporated into a flexible console arrangement to provide real-time man-computer interaction, a CDC 160A computer to provide instantaneous real-time service for the smaller service processes, and a telephone tie-line connecting this computer as a satellite to the Q32 computer in the Command Laboratory (an ARPA-supported activity) at Systems Development Corp., in Santa Monica. The Q32 is a fast computer of the SAGE class, with 48-bit word length, 65-thousand-word core memory, 500,000 words of high-speed drum storage, 18 tape transports, that is to be operated in a time-sharing mode to give service to a number of satellite computers, display consoles, and teletypewrite stations.

II RELEVANT PROJECT EXPERIENCE

The following briefs are illustrative of projects carried out at Stanford Research Institute that are relevant to the study described in this proposed area.

1. Study of the Scientist-to-Scientist Communication Patterns of the U. S. Biomedical Research Community

The National Academy of Sciences/National Research Council, with NIH support, has formed a Task Force study group that is currently studying the

information problems of the U. S. biomedical researchers. One member of the SRI staff has been an active member of this study group. This project has been concerned primarily with determining the nature of the information problems of biomedical researchers; determining what sources and channels of information are available, and what their limitations are; and what improvements might be considered on a local and national scale to improve the information services and scientist-to-scientist communication.

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and hardware design, the development of coding systems, and the implementation of a working model have already been completed.

5. Information Needs of Physicians

Under commercial sponsorship, a basic research study was conducted to explore the total information needs of physicians, and the extent to which journal publications--and one journal in particular--can meet these needs. Interviews were held with a number of practicing physicians as part of the effort to determine their information needs.

6. Availability of Japanese Technical Literature for U. S. Scientists

Under National Science Foundation sponsorship, the Institute recently conducted a study of the availability of the Japanese technical literature for U. S. scientists. This included the identification of major sources and depositories of this information in the U. S., and the extent to which translations are available.

7. Establishment of the Air Pollution Information Center

With support by the San Francisco Bay Region Air Pollution Control District, a comprehensive information center was developed by the Institute to serve as a single and comprehensive collection of information on air pollution and related topics. This file now serves as the core of the District's present technical information center.

8. Development of an Information Management System for Cooperative Man-Computer Relationships

With support from the Air Force Electronic Systems Division and the Advanced Research Projects Agency, the Institute is currently working on a comprehensive study to investigate, design, and construct information management systems that will operate in the environment of a cooperative man-computer system. Experimental facilities are being developed and used for the real-time search, display, and processing of information, using large digital computers, data communication facilities, and display consoles or work stations with cathode-ray-tube displays and various other input-output devices. This experimental facility will be used for the computer interrogation and processing of large files of data from remote user stations, with provisions for relatively easy communication between the user and the machine system.

9. Aerial Reconnaissance Data Processing

Another project which was completed after a two-year effort was the design and implementation of a complete data-handling system for an aerial reconnaissance project (ULD-1 Electronic Recon System - Contract AF 33(604)17231. This effort included system studies, computer selection, installation planning, program writing, and assistance with the final system test. For this project, a large data processing system was installed at the Institute for the programming and testing effort, and subsequently delivered to the client as a complete, operating system. Some special-purpose equipment such as magnetic tape converters, and special man-machine operator consoles were also developed as part of this program.

The following is a partial listing of other related research projects:

A graphical data processing study, which considered the handling of raw data, identification, programming, selection, indexing, storage, access to storage, and presentation.

Development of an information system to aid in controlling the leadtime of a variety of significant military research and development projects.

Development of a technique for high-speed automatic reading of printed alphanumerical material.

Development of the Videograph printer for the transfer of video images to paper.

Development of high-speed document handling techniques.

Research to develop a system of materials suitable for draftsmen to use in making original drawings which would be reproducible by transmission photocopying.

Mobilization planning studies for various agencies with the DOD, which considered detailed manufacturing problems and the transition from drawings to hardware.

Procurement planning and control studies, including major activity on the "Missile Manufacturer's Planning Report."

Studies of storage means for graphical data, including microfilming.

Studies on the encoding of data in operational situations.

III RELEVANT STAFF PUBLICATIONS

The following publications by SRI personnel are a further illustration of the background and interests of the Institute staff as relevant to the study described in this proposed area.

Bourne, C. P., Methods of Information Handling (John Wiley and Sons, Inc., New York, New York, 1963.

Bourne, C. P., "The World's Technical Journal Literature: An Estimate of Volume, Origin, Language, Field, Indexing, and Abstracting," American Documentation 13, 2, pp. 159-168 (April 1962).

Bourne, C. P., "Problems Posed by an Expanding Technical Literature," IRE Trans.PGEWS-5, 1, pp. 2-8 (August 1962).

Bourne, C. P., "A Review of the Methodology of Information System Design," in Information Systems Workshop: The Designer's Responsibility and his Methodology, pp. 11-36 (Spartan Books, Washington D. C., 1962)

Bourne, C. P., "The Historical Development and Present State of the Art of Mechanized Information Retrieval Systems," American Documentation 12, 2, pp. 108-110 (April 1961).

Bourne, C. P., "The Beginnings of Automation of Technical Drafting, Writing, and Editing Functions," Proc. of the Eighth Annual Convention of the Society of Technical Writers and Publishers, pp. 57-65 (STWP, Inc., Columbus, Ohio, 1961).

Bourne, C. P., "A Bibliography on the Mechanization of Information Retrieval," Stanford Research Institute, Menlo Park, California (February 1958). Annual supplements 1, 2, 3, 4, issued in February of 1959, 1960, 1961, 1962 repectively.

Bourne, C. P., "The Organization of a Memory System for Information Retrieval Applications" Supplement B to Quarterly Report 2, SRI Project 3101, Contract AF 30(602)-2142, Rome Air Development Center, Griffiss Air Force Base, Rome, New York (June 1960).

Bourne, C. P. and D. C. Engelbart, "Facets of the Technical Information Problem," SRI Journal, 2, No. 1, pp. 2-8 (1958). ^lso reprinted in Datamation (September 1958).

Bourne, C. P., G. D. Peterson, B. Lefkowitz, and D. Ford, "Requirements, Criteria, and Measures of Performance of Information Storage and Retrieval Systems," Stanford Research Institute Report to the National Science Foundation (December 1961), ASTIA No. AD-270 942, OTS price $10.50.

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IV BIOGRAPHIES OF PERTINENT STAFF PERSONNEL

Tomlin, Frederick K. - Mathematician, Mathematical Sciences Department

Mr. Tomlin received a B.A. degree in 1954 and an M.S. degree in 1958, both in Mathematics from San Jose State College. During 1954-1956 he served in the U.S. Army.

Mr. Tomlin joined the staff of Stanford Research Institute in June 1958. He has since engaged in mathematical research and analysis for an Air Force sponsor. At this time he was also occupied with the development of programs for a Burroughs 220 Data Processor to evaluate the results of his previous research and analysis, and development and integration of subroutines and machine language programs to be used as a basis for a large data-handling system.

He has done extensive programming of scientific and data-handling problems using machine, assembler, and compiler (Burroughs ALGOL) language and in the process has obtained considerable experience using magnetic tapes, Programs include radio signal strength predictions, atomic casualty study, and circuit simulation. He developed the computer operating system that controls the operation of all programs run at the SRI computer facility.

Presently he is working on a project to develop COBOL for the Burroughs 220 Data Processor. Specifically, he is developing generators and subroutines for the input-output verbs (OPEN, CLOSE, READ, WRITE, POSITION), the arithmetic verbs (ADD, SUBTRACT, MULTIPLY, DIVIDE), and others (including MOVE and EXAMINE).

His programming experience includes the use of the CDC 160A, Burroughs 220, and the IBM Q32.

Mr. Tomlin is a member of the Association for Computing Machinery.

Humphrey, Thomas L. - Research Engineer, Systems Engineering Laboratory

In October 1962 Mr. Humphrey joined the staff of Stanford Research Institute, where he has been engaged in research in man-machine interactions and mechanization of man-machine systems. His interests in this area include programming techniques and systems and logical organization processes.

In 1960 he joined A. C. Spark Plug Division of General Motors, where he worked on design and analysis of ground-support equipment for the MACE inertial guidance system. In 1961 he moved to the Advanced Research and Development Section, where he was concerned with computer system performance and reliability models and with logical design and organization techniques for reliability improvement of space-borne digital computers.

His special skills include control systems, logical design and organization, systems analysis and modeling, computer programming (using computer, assembly and list processing languages), and circuits.

Mr. Humphrey received a B.S. degree in Applied Physics from the University of California at Los Angeles in 1960 and an M.S. degree in Electrical Engineering from Stanford University in 1961. He is currently a candidate for the degree of Ph.D. at Stanford University, being concerned with the area of man-machine systems.

Mr. Humphrey is a member of Sigma Pi Sigma, Pi Mu Epsilon, Phi Beta Kappa, the Institute of Electrical and Electronics Engineers, and the IEEE Professional Technical Groups on Electronic Computers, on Control Systems, and on Space Electronics and Telemetry.

+ Charter
Wallace
Bourne
Wensley
Englebart
Sys Brochure

Conclusions

In conclusion it can be stated that a single information processing and retrieval system can be designed that will suit divergent disciplines. This is proven by the operation for more than a year of the same index publishing system for such widely differing subjects as metallurgy, plastics and electrical engineering. (9)

A second conclusion is that absolute dedication to the principle of joint cooperation and communication is essential. The effort is painful, and the price is high.

The implications of success, however, go far beyond the benefits to be realized by the three cooperating agencies. As a matter of fact, the efforts being put forth will not necessarily compensate the cooperating organizations fully from the standpoints of immediate monetary return or prestigious benefit. But if the program is a success, as now anticipated, it will indeed form a pilot module in the proposed United Engineering Information System and Network, and will prove that the concept of interrelated information systems is capable of practical realization.

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File Systems
STEP

MACHINE EXTRACTING PROGRESS

by

J. McNAMARA

and

D. STONE

Rome Air Development Center

Griffiss Air Force Base

New York

xc Bunker-Ramo
TRW
STEP Project

ABSTRACT

This paper discusses the results of this testing program and indicates where progress has been made and where extracting research may go in the future. The task of screening, as defined within the context of the text design, is best supported by the text condition of title plus topic tags. In no field did performance, using abstracts, approach that using the full text. The results indicate that the CLUE abstracts are an acceptable replacement for STEP abstracts in the fields of Chemistry and Electrical Engineering. This suggests that future extracting research may have to proceed on a field-by-field basis with special dictionaries for each field.

RADC
STEP

For the past five years the Rome Air Development Center (RADC), in conjunction with a number of contractors, has been engaged in the

Proc. ADI 1966 Mtg.
Adrienne Press

development of computer extracting routines to produce abstracts of technical articles.* Based on this research, an extracting algorithm was developed called the CLUE technique. In parallel with the machine research program, there has also been a study to identify the purposes of abstracts and what information they should contain to support these uses. (2) (3) A testing program, recently completed, evaluates the utility of the developed extracting routines. In addition, research is in progress to strengthen the CLUE extracting technique for Russian scientific text. Other research is exploring the information requirements of an abstract, whether manually or automatically prepared.

This paper discusses the results of this testing program and indicates where progress has been made and where extracting research may go in the future. For purposes of this discussion, only summary data of average test scores is presented. A detailed report by the American Institute for Research (AIR) concerning the entire testing program, with its associated statistical analysis, is available. (3) However, the same inferences can be drawn by analyzing the data in either way.

The CLUE extracting technique was developed by the Bunker-Ramo Corporation for RADC. The principal investigators were Dr. D. Swanson, University of Chicago, and Dr. H. P. Edmundson, System Development Corporation. As the name implies, the program attempts to utilize various machine recognizable clues, such as the occurrence of a particular word in a sentence, the location of a sentence, etc., for weighting the sentences in the document. A fixed percentage of the highest weighted sentences are then selected to form the abstract of the article. The clues are derived by statistically examining manually prepared abstracts; looking for parameters which could be used by the machine. The CLUE program was originally developed for use on English scientific text. However, due to a particular Air Force interest, the program was modified to produce abstracts of Russian scientific text. (5) This point is significant since little or no effort was made to orient the routine toward the Russian scientific text.

Based on a previous round of evaluations using abstracts of English documents, it was decided to include only the screening and comprehension-retention (C-R) tasks in this evaluation. (3) It was in these two tasks that abstracts compared favorably with full text. Eight text conditions were evaluated in the screening task and seven in the C-R task. These included three machine produced abstracts and three manually produced abstracts. The text conditions were:

* The term extracting is used to describe the process of lifting sentences from a document to form a surrogate of the document. The term abstract is used to describe the resulting surrogate since the intent is to produce an abstract or summary of the article.

1. Full Text—This is the entire document manually translated from Russian to English. It is considered standard against which all other text conditions are to be compared.

2. CLUE + Abstract—This is the abstract produced by the algorithms developed by Bunker-Ramo and reprogrammed for the Russian language. The abstract was then manually translated into English. The + sign indicates that formulae, etc., which were deleted during the keypunching process, were replaced after the abstract had been translated.

3. CLUE Abstract—This is the same as 2 above except the formulae were **not** added after the translation.

4. Frequency + Abstract—This is the abstract produced by applying version #5 of the extracting algorithm developed under the Asci-matic Program to Russian text. (6) The Russian abstract was then manually translated and the formulae replaced.

5. STEP Abstract—This is an English abstract produced by contractors for an Air Force organization. It is made by people who read the Russian language and are knowledgeable in the subject area covered by the document. It is generally considered to be an informative abstract.

6. AIR Full Abstract—This is an abstract prepared from a manual translation according to rules for manual abstracting derived under an earlier contract with the American Institute for Research.

7. AIR Tailored Abstract—This is a sub-set of condition 6 which tailors an abstract towards the screening or comprehension-retention task.

8. Topic Tags—These are the index terms, title, author, and other bibligraphic information assigned to the document by the same persons who prepare the STEP abstract described under 5 above. This text condition was used only in the screening task.

Screening —

The evaluation consisted of generating a set of test questions for the task of screening. Screening consisted of having persons choose documents which were considered relevant to the test questions.

1. Test Design —

Four different levels of screening were tested using eight text conditions in each of four fields. The levels were operationally defined so that in Level I, 10 to 12 documents were relevant; Level II, 7 to 9 were relevant; Level III, 4 to 6 were relevant; and Level IV, 1 to 3 were relevant.

2. Results —

The results depicted below are the scores for each text condition in each field averaged over the four levels of screening.

FIELDS	TEXT CONDITIONS							
	Standard	Computer Algorithms			Manual Procedures			
	Full Text	CLUE+	CLUE	FREQ+	STEP	AIR(F)	AIR(T)	TT
Chemistry	75.8	77.6	77.5	73.0	71.3	73.0	69.8	68.3
EE	70.2	65.9	73.5	69.1	71.6	76.2	65.9	69.5
Physics	77.6	78.3	79.1	78.6	84.8	77.6	75.5	73.3
Math	57.2	57.5	48.8	47.2	56.6	55.6	55.3	60.1

3. Discussion of Results

Although it cannot be seen from the table because accuracy scores were averaged over the four levels of screening, there was a general increase in accuracy for all text conditions as the speficity of screening was increased, i.e., the number of relevant documents became less. This trend would certainly be expected using the full text, and probably by using the abstracts. The more specific the question the easier it is to recognize an answer to the question. However, because of the minimum information available, one would expect performance to level off or decrease when only title and topic tags are used. The fact that this did not occur could be due to the nature of the document collection and/or the screening tests themselves.

The task of screening then, as defined within the context of the design, is best supported by the eighth text condition of title plus topic tags. Persons using this text condition did as well as those using any other text condition, and they required less time.

Comprehension-Retention —

The task of comprehensive-retention is considered analogous to keeping abreast of one's field of interest. The questions, when answered correctly, would indicate a general understanding of the article.

1. Test Design —

The test was designed to examine performance on the C-R task in four fields using seven text conditions. Fourteen documents per field were used to generate four questions per test. Five undergraduate students were used for each text condition in each field making a total of 35 subjects per field. Each student was cycled across the text conditions twice per field.

2. Results —

The results shown below are the average of the 10 scores obtained for each condition in each field.

FIELDS	TEXT CONDITIONS						
	Standard	Computer Algorithms			Manual Procedures		
	Full Text	CLUE+	CLUE	FREQ+	STEP	AIR(F)	AIR(T)
Chemistry	46.7	30.4	23.7	16.9	26.1	41.3	30.2
EE	60.6	37.8	34.3	19.7	37.8	37.4	29.0
Physics	66.4	33.3	31.3	36.8	42.1	43.0	40.8
Math	45.4	12.4	7.4	9.4	25.8	19.8	21.2

3. Discussion of Results

Many comparisons between scores can be made in both the verticle and the horizontal directions. However, only those that might shed some light on future extracting research will be considered.

The first significant comparison can be made between the full text and all other abstract conditions. In no field did performance, using an abstract, approach that using the full text. The AIR full abstract was designed to replace the full text, as abstracts are at times used in this way. Apparently, however, it did not replace satisfactorily the full text for the C-R task.

Another general result that is obvious concerns the frequency abstract. The scores are consistently lower using the frequency abstract than using any other text condition. This result is consistent with an earlier gross evaluation conducted by Bunker-Ramo as part of the machine extracting research program.

In the field of Mathematics the performance was considerably lower. using abstracts, in relation to full text, than in any other field. This may be because there is less redundancy in mathematics reports than those for other fields.

Within the field of Mathematics the scores attained using manual abstracts were significantly better than those using machine-produced abstracts. This may be because the current machine extracting algorithms do not consider what is probably the most important part of a mathematics document—the formulae. This factor could also explain why persons in the field of Physics performed better with manually produced abstracts. Some of the more important sentences in Physics documents also contain mathematical formulae.

RADC is particularly interested in the comparisons between the CLUE abstracts and the STEP abstracts. The STEP abstracts represent the current operational capability at FTD while the CLUE abstracts are a candidate for their replacement. The results indicate that CLUE abstracts are an acceptable replacement for STEP abstracts in the fields of Chemistry and Electrical Engineering. In Physics and Mathematics, however, the STEP abstracts support the C-R task better. For obvious reasons it was hoped that the CLUE abstract, without the formulae added, could compete with the STEP abstracts. As the results indicate, however, they cannot.

Progress and Direction

As often happens, the test results answer some questions and raise other new ones. No one point stands out in the data to provide specific direction.

The results of the screening test are in one sense ironic. The original goal of the automatic extracting program was to provide abstracts suitable at least for the screening task, with hopes that they might support some other complex tasks as well. From the results, the abstracts produced by CLUE technique support the screening task quite well. However, we have also demonstrated that index terms plus a title are more efficient. Hence, if the goal of an announcement vehicle is to provide a surrogate of a document which users can evaluate, the results indicate that no abstract (manual or automatic) is required. There is still a nagging thought that this result may be biased by our inability to translate operational screening requirements into a sterile test condition. It is our intention to test this result on a larger scale in a semi-controlled operational environment.

It was originally hypothesized that the CLUE extracting program would be subject-area independent. However, the results indicate a definite variation from one subject field to another. In fact, the CLUE abstracts, in relation to full text, were best for Chemistry—the very field from which the original CLUE algorithms and dictionaries were derived. This would indicate that future extracting research may have to proceed on a field-by-field basis with special dictionaries for each field. The current effort at Autonetics will concentrate on the Medical Sciences field. It will be interesting to see if dictionaries oriented toward medical subjects sustain our hypothesis. Autonetics is also experimenting with an adaptive algorithm that could allow semi-automatic orientation toward any chosen field. If successful, the task of building special dictionaries will not be so difficult or time consuming.

At the heart of future extracting research lies the evaluation question. If one accepts this kind of utility evaluation, several things become apparent. First, we must know a great deal more about the intended user's needs than we now know. From a detailed analysis of his requirements one can distill certain common tasks supported by textual material.

These tasks should lead to information requirements, some of which can be satisfied with a reduced form of text.

The need to pinpoint information requirements becomes particularly acute when we consider giving the user direct access to a computer via console. We cannot afford to store or process the entire document if some surrogate of it will suffice. The user's participation is also required to evaluate any new or potential improvement in extracting techniques.

The results of the tests indicate an improvement in going from the frequency to the CLUE extracting approach .A similar jump in performance would bring us close to the full text. Where is this improvement to come from? Part of it will come from tailoring the CLUE algorithms to the Russian language and part will come from tailoring them to other fields. By then the CLUE approach will have reached maximum use. The next step is to provide a syntactic capability for linking sentences related to those chosen by the various clues. This plan is supported by Dr. Edmundson as an avenue for further research. The question is whether the additional complexity added to the program will be worth the effort.

For extracting purposes perhaps there are ways to classify documents other than by language and subject area. What about length of the document? What about document type such as descriptive, narrative, argumentative, tutorial, evaluative, or state-of-the-art? Are these useful classifications? We don't know. One might describe this paper as a narrative description educating the reader in the arguments germane to evaluating the state-of-the-art of extracting. In short, we're looking for new ideas in the field of machine extracting.

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SRI PROJECT NO. E? 2446 --Task I (641) ACC. NO. 5121 ✓

REPORT NO. Special TR 12 COPY NO. 38, 39

CLIENT Hoffman Electronics Corporation

CONTRACT NO. P.O. L-02003 under AF 33(604)-17231

TITLE INSTALLATION, ACCEPTANCE TESTING, AND PERFORMANCE RECORD OF THE OA-2214(XH-1)/GSQ-39

AUTHOR Charles P. Bourne

DATE ISSUED 11/59

CLASSIFICATION U

LAB NOTEBOOK NO.

SRI PROJECT NO. E4 2684 ora 643 ACC. NO. 4900 DX-23446 ✓

SRI PROJECT NO. ESD-2446 --Task I (641) ACC. NO. 5834

D-0-393

REPORT NO. Final Engineering Rept. Computer Group. Vol. 1 COPY NO. 33, 34

CLIENT Hoffman Electronics Corporation

CONTRACT NO. P.O. L-02003 under AF 33(600)-17231

TITLE COMPUTER AND PROGRAMMING SYSTEM FOR OA-2214(XH-1)/GSQ-39

AUTHOR Charles P. Bourne, Donald F. Ford

DATE ISSUED 4/60

CLASSIFICATION S

LAB NOTEBOOK NO.
FO-C-68
D-C-393

The objectives and method of approach for this project[4] also are a direct outgrowth of the AFOSR-sponsored study. The project began in July, 1963, and proceeds at a 2½ to 3-man level. Dealing only with software and system development (using hardware and basic software of the ARPA project), this project concentrates on improving the management of information involved in minute-by-minute, day-by-day and month-by-month problem-solving activity of a computer programmer and of a research group. The developments of this project will be used and evaluated not only by programmers within the ARPA-project programmer-aid system (and hence by our own researchers in their programming activity), but by the growing list of researchers (of section 2.1) in our coordinated augmented-human-intellect program for managing their individual, group, and external-source working information. Again, improved management is pursued by integrating real-time computer aids with new language and data structures, and new methods and procedures, within a coordinated working system.

3.2 Large Information Processing Systems

3.21 The Institute designed for the Air Force (Air Technical Intelligence Center), a comprehensive system for the systematic acquisition, abstracting, translating, dissemination, review, storage, and retrieval of a significant segment of the open-source foreign scientific literature. During the course of this project a comprehensive review was made of the operation and techniques of several of the largest technical information files maintained by the Air Force and other government agencies.

GSQ-39

3.22 Another project which was completed after a two-year effort was the design and implementation of a complete data-handling system for an aerial reconnaissance project (ULD-1 Electronic Recon System - Contract AF 33(604)17231. This effort included system studies, computer selection, installation planning, program writing, and assistance with the final system test. For this project, a large data processing system was installed at the Institute for the programing and testing effort, and subsequently delivered to the client as a complete, operating system. Some special-purpose equipment such as magnetic tape converters, and special man-machine operator consoles were also developed as part of this program.

3.3 Miscellaneous Projects Related to Large Information Processing Systems.

Several related projects have been conducted by the Institute in various phases of the technical information problems, both in gross and specialized aspects of data handling, storage, and retrieval.

SUBJECT: Real-Time Computer Aid for Human Information Manipulation

copy to (RADC) CB project files (4)

REFERENCE: RAW-64-579 -- From PSA 16 September 1963

GSQ-39

TO: Directorate of Procurement
Rome Air Development Center
Attn: RAKS
Griffiss Air Force Base, New York 13442

1.0 Stanford Research Institute

Stanford Research Institute is a not-for-profit corporation chartered by the State of California. The Institute was founded in November, 1946 by action of the Trustees of Stanford University, and many members of the Board of Directors of the Institute are also on the Board of Trustees of the University, although there is no operational connection between the two organizations. Headquarters and principal laboratories of the Institute are at Menlo Park, California. Regional Office locations include New York City, Detroit, Wash. D.C., Pasadena, Calif., Tokyo, Japan, and Zurich, Switzerland.

SRI is one of the largest research institutes, with excellent facilities, and a highly competent research staff with broad interests, training, and experience in the physical sciences, life sciences, engineering, and economics. The Institute has a total staff of 2300 persons, of whom over 1,200 are in technical and professional categories. Advance degrees are held by 600 staff members; of these 275 hold Ph.D. or equivalent degrees. The Institute has Top Secret clearance under Western Contract Management Region (RWIP), United States Air Force, Mira Loma Air Force Station, Mira Loma, Calif.

2.0 Qualifications and Facilities

2.1 Personnel: Eight professionals are engaged full time in original and coordinated research that is directly relevant to the subject research. Nine other professionals are providing part-time backup service in engineering, psychology, content analysis, and systems analysis.

2.2 Special Facilities: (A) Experimental laboratory equipped with a character generator and cathode-ray-tube display incorporated into a flexible console arrangement to provide real-time man-computer interaction. A CDC 160A computer to provide instantaneous real-time service for the smaller service processes (B) a telephone tie-line connecting this computer as a satellite to the Q32 computer in the Command Laboratory (an ARPA-supported activity)at Systems Development Corp., in Santa Monica. The Q32 is a fast computer of the SAGE class, with 48-bit word length, 65-thousand-word core memory, 500,000 words of high-speed drum storage, 18 tape transports, that is to be operated in a time-sharing mode to give service to a number of satellite computers, display consoles, and teletypewrite stations. [It's storage is to be increased next year with the addition of a high-transfer-rate disk file and words of core.]

2.3 Objectivity, since Stanford Research Institute is a not-for profit organization, does not hold patents, and it is not in manufacturing nor sales.

The objectives and method of approach for this project also are a direct outgrowth of the AFOSR-sponsored study. The project began in July, 1963, and proceeds at a $2\frac{1}{2}$ to 3-man level. Dealing only with software and system development (using hardware and basic software of the ARPA project), this project concentrates on improving the management of information involved in minute-by-minute, day-by-day and month-by-month problem-solving activity of a computer programmer and of a research group. The developments of this project will be used and evaluated not only by programmers within the ARPA-project programmer-aid system (and hence by our own researchers in their programming activity), but by the growing list of researchers (of section 2.1) in our coordinated augmented-human-intellect program for managing their individual, group, and external-source working information. Again, improved management is pursued by integrating real-time computer aids with new language and data structures, and new methods and procedures, within a coordinated working system.

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GSQ-39

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"copy" ... AB project files (6)

ULD-1

SUBJECT: Engineering Services for the Design of a System for Searching and Extracting Information

REFERENCE: E-4-109, from PSA 3470, 17 January 1964

TO: Procurement Division
Rome Air Development Center
Attn: EMKS
Griffis AFB, N.Y. 13442

Stanford Research Institute

Stanford Research Institute is a not-for-profit corporation chartered by the State of California. The Institute was founded in November, 1946 by action of the Trustees of Stanford University, and many members of the Board of Directors of the Institute are also on the Board of Trustees of the University, although there is no operational connection between the two organizations. Headquarters and principal laboratories of the Institute are at Menlo Park, California. Regional Office locations include New York City, Detroit, Washington, D.C., Pasadena, California, Tokyo, Japan, and Zurich, Switzerland.

SRI is one of the largest research institutes, with excellent facilities, and a highly competent research staff with broad interests, training, and experience in the physical sciences, life sciences, engineering, and economics. The Institute has a total staff of 2368 persons, of whom over 1300 are in technical and professional categories. Advance degrees are held by 600 staff members; of these 323 hold Ph.D. or equivalent degrees. The Institute has Top Secret clearance under Western Contract Management Region (RWIP), United States Air Force, Mira Loma Air Force Station, Mira Loma, California.

I QUALIFICATIONS AND FACILITIES

SRI has considerable experience in the design and evaluation of large information systems. The Institute maintains an up-to-date awareness of problems in the distribution and use of scientific and technical information, as well as the research being done on these problems. SRI itself has performed some studies of information resources and the problems of scientific and technical information. SRI currently operates one of the AEC Depositories and maintains its own technical report collection.

We believe that the independent nature of the Institute lends further strength to our capability in system design and evaluation; we do not produce commercial equipment, nor are we in any way allied with a particular manufacturer of data-handling equipment. At the same time, our direct contact with many manufacturers and other research organizations ensures our awareness of their progress in information-handling and related fields. Rapport with manufacturers and possession of in-house systems engineering talent have allowed us to carry out more efficiently all the phases of information-handling system implementation, from initial problem definition through design and analysis, equipment selection, detailed programming and installation, to final user acçeptance-testing.

The Systems Engineerin g Laboratory of the Engineering Sciences Division is engaged in the analysis, design, and evaluation of large-scale information systems. Its programs have both an applied and a basic research component. The applied activities result in the generation of system designs in response to the specific needs of a client. The basic research activities are directly concerned with the development of improved analysis and design techniques. The work maintains a strong multi-disciplinary character. On the one hand, detailed engineering knowledge is required of the current and projected state-of-the-art for computer, communications, and control equipment. At the same time, considerable skill is required in the application of those tools that provide insight into the properties of large-scale systems--queuing theory, linear programming, information theory, modeling, graph theory, simulation, and optimization methods.

Members of this Laboratory have participated in the design of a number of large-scale systems, including a nationwide airline space-reservation system interconnecting automatic data processors and agents set in a complex communication pattern; a nationwide system for processing and disbursing commercial bank checks; a comprehensive facility for the reduction and analysis of electronic reconnaissance data; an electronically instrumented system for automatically evaluating the combat effectiveness of mobile military units; a very large memory for information retrieval problems; and a system for processing graphic information (pattern recognition) with digital computer techniques. Most recently, the members of the Laboratory have led the design effort on the Nimbus weather satellite data-handling system.

General Facilities

Extensive facilities and equipment are available to support the diversified requirements of multi-disciplinary research and development projects.

Special Facilities

Experimental laboratory equipped with a character generator and cathode-ray-tube display incorporated into a flexible console arrangement to provide real-time man-computer interaction, a CDC 160A computer to provide instantaneous real-time service for the smaller service processes, and a telephone tie-line connecting this computer as a satellite to the Q32 computer in the Command Laboratory (an ARPA-supported activity) at Systems Development Corp., in Santa Monica. The Q32 is a fast computer of the SAGE class, with 48-bit word length, 65-thousand-word core memory, 500,000 words of high-speed drum storage, 18 tape transports, that is to be operated in a time-sharing mode to give service to a number of satellite computers, display consoles, and teletypewrite stations.

II RELEVANT PROJECT EXPERIENCE

The following briefs are illustrative of projects carried out at Stanford Research Institute that are relevant to the study described in this proposed area.

1. Study of the Scientist-to-Scientist Communication Patterns of the U. S. Biomedical Research Community

The National Academy of Sciences/National Research Council, with NIH support, has formed a Task Force study group that is currently studying the

information problems of the U. S. biomedical researchers. One member of the SRI staff has been an active member of this study group. This project has been concerned primarily with determining the nature of the information problems of biomedical researchers; determining what sources and channels of information are available, and what their limitations are; and what improvements might be considered on a local and national scale to improve the information services and scientist-to-scientist communication.

2. A Preliminary Study of the Requirements, Criteria, and Measures of Performance of Information Storage and Retrieval Systems

A preliminary study was made for the National Science Foundation of the requirements, criteria, and measures of performance of information storage and retrieval systems. Specifically, the objectives were: (1) to develop a methodology for determining user's information requirements; (2) to obtain specific data about the information requirements of a particular community of users; (3) to develop a preliminary set of criteria and a procedure that could be applied to existing information retrieval systems in order to reach tentative conclusions about the desirability of such systems; (4) to develop measures of system performances; and (5) to develop plans for a research program for the longer-range development of more basic and exhaustive criteria and methods for the assessment of alternative systems and procedures.

3. Technical Assistance in Implementation of the STEP Program

As a systematic means of reviewing a selected portion of this literature--and of separating important material from unimportant material--the Scientific Technical Exploitation Program (STEP) was established. SRI contracted with the Air Technical Intelligence Center (ATIC) to provide specific guidance on the immediate implementation of STEP and to give technical assistance to ATIC in the preparation of descriptive specifications of a semi-automated system for the entire STEP program.

The general objective was to develop a system by which a continuous scrutiny of Soviet Technical and scientific literature would provide timely and improved technical information about the Soviet technical potential, as well as providing valuable information to the R&D community, and aid in the proper guidance of Air Force research and development programs.

4. MIRF

Under Air Force sponsorship, the Institute is currently studying a special approach to the problem of implementing and using very large files of information. Progress is being made on the hardware and organization design of a Multiple Instantaneous Response File (MIRF) for information retrieval. This particular file device differs from other types of memories in these respects: in response to a question, all the contents of the entire file are searched simultaneously, rather than in sequential fashion, to select those file items that satisfy the search request; all of the answers are provided in a fraction of a second; and provision is made for handling multiple simultaneous answers to the same question. This type of device would ultimately permit a user to pose a question to a file of a million or more items and obtain the answer essentially instantaneously. The logical and

and hardware design, the development of coding systems, and the implementation of a working model have already been completed.

5. Information Needs of Physicians

Under commercial sponsorship, a basic research study was conducted to explore the total information needs of physicians, and the extent to which journal publications--and one journal in particular--can meet these needs. Interviews were held with a number of practicing physicians as part of the effort to determine their information needs.

6. Availability of Japanese Technical Literature for U. S. Scientists

Under National Science Foundation sponsorship, the Institute recently conducted a study of the availability of the Japanese technical literature for U. S. scientists. This included the identification of major sources and depositories of this information in the U. S., and the extent to which translations are available.

7. Establishment of the Air Pollution Information Center

With support by the San Francisco Bay Region Air Pollution Control District, a comprehensive information center was developed by the Institute to serve as a single and comprehensive collection of information on air pollution and related topics. This file now serves as the core of the District's present technical information center.

8. Development of an Information Management System for Cooperative Man-Computer Relationships

With support from the Air Force Electronic Systems Division and the Advanced Research Projects Agency, the Institute is currently working on a comprehensive study to investigate, design, and construct information management systems that will operate in the environment of a cooperative man-computer system. Experimental facilities are being developed and used for the real-time search, display, and processing of information, using large digital computers, data communication facilities, and display consoles or work stations with cathode-ray-tube displays and various other input-output devices. This experimental facility will be used for the computer interrogation and processing of large files of data from remote user stations, with provisions for relatively easy communication between the user and the machine system.

9. Aerial Reconnaissance Data Processing

Another project which was completed after a two-year effort was the design and implementation of a complete data-handling system for an aerial reconnaissance project (ULD-1 Electronic Recon System - Contract AF 33(604)17231. This effort included system studies, computer selection, installation planning, program writing, and assistance with the final system test. For this project, a large data processing system was installed at the Institute for the programming and testing effort, and subsequently delivered to the client as a complete, operating system. Some special-purpose equipment such as magnetic tape converters, and special man-machine operator consoles were also developed as part of this program.

The following is a partial listing of other related research projects:

A graphical data processing study, which considered the handling of raw data, identification, programming, selection, indexing, storage, access to storage, and presentation.

Development of an information system to aid in controlling the leadtime of a variety of significant military research and development projects.

Development of a technique for high-speed automatic reading of printed alphanumerical material.

Development of the Videograph printer for the transfer of video images to paper.

Development of high-speed document handling techniques.

Research to develop a system of materials suitable for draftsmen to use in making original drawings which would be reproducible by transmission photocopying.

Mobilization planning studies for various agencies with the DOD, which considered detailed manufacturing problems and the transition from drawings to hardware.

Procurement planning and control studies, including major activity on the "Missile Manufacturer's Planning Report."

Studies of storage means for graphical data, including microfilming.

Studies on the encoding of data in operational situations.

III RELEVANT STAFF PUBLICATIONS

The following publications by SRI personnel are a further illustration of the background and interests of the Institute staff as relevant to the study described in this proposed area.

Bourne, C. P., Methods of Information Handling (John Wiley and Sons, Inc., New York, New York, 1963.

Bourne, C. P., "The World's Technical Journal Literature: An Estimate of Volume, Origin, Language, Field, Indexing, and Abstracting," American Documentation 13, 2, pp. 159-168 (April 1962).

Bourne, C. P., "Problems Posed by an Expanding Technical Literature," IRE Trans.PGEWS-5, 1, pp. 2-8 (August 1962).

Bourne, C. P., "A Review of the Methodology of Information System Design," in Information Systems Workshop: The Designer's Responsibility and his Methodology, pp. 11-36 (Spartan Books, Washington D. C., 1962)

Bourne, C. P., "The Historical Development and Present State of the Art of Mechanized Information Retrieval Systems," American Documentation 12, 2, pp. 108-110 (April 1961).

Bourne, C. P., "The Beginnings of Automation of Technical Drafting, Writing, and Editing Functions," Proc. of the Eighth Annual Convention of the Society of Technical Writers and Publishers, pp. 57-65 (STWP, Inc., Columbus, Ohio, 1961).

Bourne, C. P., "A Bibliography on the Mechanization of Information Retrieval," Stanford Research Institute, Menlo Park, California (February 1958). Annual supplements 1, 2, 3, 4, issued in February of 1959, 1960, 1961, 1962 repectively.

Bourne, C. P., "The Organization of a Memory System for Information Retrieval Applications" Supplement B to Quarterly Report 2, SRI Project 3101, Contract AF 30(602)-2142, Rome Air Development Center, Griffiss Air Force Base, Rome, New York (June 1960).

Bourne, C. P. and D. C. Engelbart, "Facets of the Technical Information Problem," SRI Journal, 2, No. 1, pp. 2-8 (1958). ^lso reprinted in Datamation (September 1958).

Bourne, C. P., G. D. Peterson, B. Lefkowitz, and D. Ford, "Requirements, Criteria, and Measures of Performance of Information Storage and Retrieval Systems," Stanford Research Institute Report to the National Science Foundation (December 1961), ASTIA No. AD-270 942, OTS price $10.50.

Engelbart, D. C., "Special Considerations of the Individual as a User, Generator, and Retriever of Information," American Documentation, 12, 2, pp. 121-125 (April 1961).

Goldberg, J. and M. W. Green, "Large Files for Information Retrieval Based on Simultaneous Interrogation of All Items," Large-Capacity Memory Techniques for Computing Systems, pp. 63-77 (The Macmillan Company, New York, New York 1962).

Goldberg, J., M. W. Green, C. H. Heckler, Jr., E. K. Van De Riet, R. C. Singleton, and E. H. Frei, "Multiple Instantaneous Response File," Final Report, SRI Project 3101, Contract AF 30(620)-2142, Stanford Research Institute, Menlo Park, California (August 1961), AD 266 169.

IV BIOGRAPHIES OF PERTINENT STAFF PERSONNEL

Tomlin, Frederick K. - Mathematician, Mathematical Sciences Department

Mr. Tomlin received a B.A. degree in 1954 and an M.S. degree in 1958, both in Mathematics from San Jose State College. During 1954-1956 he served in the U.S. Army.

Mr. Tomlin joined the staff of Stanford Research Institute in June 1958. He has since engaged in mathematical research and analysis for an Air Force sponsor. At this time he was also occupied with the development of programs for a Burroughs 220 Data Processor to evaluate the results of his previous research and analysis, and development and integration of subroutines and machine language programs to be used as a basis for a large data-handling system.

He has done extensive programming of scientific and data-handling problems using machine, assembler, and compiler (Burroughs ALGOL) language and in the process has obtained considerable experience using magnetic tapes, Programs include radio signal strength predictions, atomic casualty study, and circuit simulation. He developed the computer operating system that controls the operation of all programs run at the SRI computer facility.

Presently he is working on a project to develop COBOL for the Burroughs 220 Data Processor. Specifically, he is developing generators and subroutines for the input-output verbs (OPEN, CLOSE, READ, WRITE, POSITION), the arithmetic verbs (ADD, SUBTRACT, MULTIPLY, DIVIDE), and others (including MOVE and EXAMINE).

His programming experience includes the use of the CDC 160A, Burroughs 220, and the IBM Q32.

Mr. Tomlin is a member of the Association for Computing Machinery.

Humphrey, Thomas L. - Research Engineer, Systems Engineering Laboratory

In October 1962 Mr. Humphrey joined the staff of Stanford Research Institute, where he has been engaged in research in man-machine interactions and mechanization of man-machine systems. His interests in this area include programming techniques and systems and logical organization processes.

In 1960 he joined A. C. Spark Plug Division of General Motors, where he worked on design and analysis of ground-support equipment for the MACE inertial guidance system. In 1961 he moved to the Advanced Research and Development Section, where he was concerned with computer system performance and reliability models and with logical design and organization techniques for reliability improvement of space-borne digital computers.

His special skills include control systems, logical design and organization, systems analysis and modeling, computer programming (using computer, assembly and list processing languages), and circuits.

Mr. Humphrey received a B.S. degree in Applied Physics from the University of California at Los Angeles in 1960 and an M.S. degree in Electrical Engineering from Stanford University in 1961. He is currently a candidate for the degree of Ph.D. at Stanford University, being concerned with the area of man-machine systems.

Mr. Humphrey is a member of Sigma Pi Sigma, Pi Mu Epsilon, Phi Beta Kappa, the Institute of Electrical and Electronics Engineers, and the IEEE Professional Technical Groups on Electronic Computers, on Control Systems, and on Space Electronics and Telemetry.

+ Charten
Wallace
Baume
Wensley
Engelbart
Sup Brochure

ULD-1 copy to RADC
GB project files (4)

SUBJECT: Real-Time Computer Aid for Human Information Manipulation

REFERENCE: RAW-64-579 -- From PSA 16 September 1963

TO: Directorate of Procurement
Rome Air Development Center
Attn: RAKS
Griffiss Air Force Base, New York 13442

1.0 Stanford Research Institute

Stanford Research Institute is a not-for-profit corporation chartered by the State of California. The Institute was founded in November, 1946 by action of the Trustees of Stanford University, and many members of the Board of Directors of the Institute are also on the Board of Trustees of the University, although there is no operational connection between the two organizations. Headquarters and principal laboratories of the Institute are at Menlo Park, California. Regional Office locations include New York City, Detroit, Wash. D.C., Pasadena, Calif., Tokyo, Japan, and Zurich, Switzerland.

SRI is one of the largest research institutes, with excellent facilities, and a highly competent research staff with broad interests, training, and experience in the physical sciences, life sciences, engineering, and economics. The Institute has a total staff of 2300 persons, of whom over 1,200 are in technical and professional categories. Advance degrees are held by 600 staff members; of these 275 hold Ph.D. or equivalent degrees. The Institute has Top Secret clearance under Western Contract Management Region (RWIP), United States Air Force, Mira Loma Air Force Station, Mira Loma, Calif.

2.0 Qualifications and Facilities

2.1 Personnel: Eight professionals are engaged full time in original and coordinated research that is directly relevant to the subject research. Nine other professionals are providing part-time backup service in engineering, psychology, content analysis, and systems analysis.

2.2 Special Facilities: (A) Experimental laboratory equipped with a character generator and cathode-ray-tube display incorporated into a flexible console arrangement to provide real-time man-computer interaction. A CDC 160A computer to provide instantaneous real-time service for the smaller service processes (B) a telephone tie-line connecting this computer as a satellite to the Q32 computer in the Command Laboratory (an ARPA-supported activity)at Systems Development Corp., in Santa Monica. The Q32 is a fast computer of the SAGE class, with 48-bit word length, 65-thousand-word core memory, 500,000 words of high-speed drum storage, 18 tape transports, that is to be operated in a time-sharing mode to give service to a number of satellite computers, display consoles, and teletypewrite stations. [It's storage is to be increased next year with the addition of a high-transfer-rate disk file and words of core.] 6

2.3 Objectivity, since Stanford Research Institute is a not-for profit organization, does not hold patents, and it is not in manufacturing nor sales.

SRI has been active in the area encompassing the subject described above for a number of years. Descriptions of representative completed and current projects are listed below. A printed brochure outlining interests and capabilities in this area, and biographies of pertinent staff personnel are attached.

3.0 Representative Prior and Present Projects

3.1 These current projects form the nucleus of a coordinated research program which was conceived and developed at SRI, and which is planned as a continuing and growing activity.

3.11 Augmented Human Intellect Study
Contract AF 49(638)-1024
Air Force Office of Scientific Research, Washington, D.C.

This project has been active since March of 1961, and represents mainly a one-man effort to set the stage for present and future research aimed at improving the effectiveness of human intellectual activity through the use of real-time computer aids. The first year and a half was mainly a conceptual study, leading to the Summary Report, "Augmenting Human Intellect: A Conceptual Framework".[1] This work set the stage for the proposals and subsequent projects with ARPA and ESD described below. Recently this AFOSR work has been concerned with basic problems in computer-aided data transcription and with detailed aspects of computer-aided "micro-documentation",[2] as well as general continued development of a research foundation for a coordinated research program in the "augmented human intellect" area.

3.12 Research on the Computer Facilitation of Computer Programming
Contract ARPA - SD-163
Advanced Research Projects Agency

A direct outgrowth of the long-term research strategy developed in the above project. The objective of this project (started March 1963, five to six man level) is to establish a computer-based experimental laboratory (equipped with real-time computer service, a computer-driven cathode-ray-tube display at a console, light pen, keyboards, etc.) and to pursue a coordinated system of computer aids, system language and data structuring, and human procedures and methods. The goal is to improve human effectiveness at the whole gamut of tasks involved in designing, writing, debugging and documenting computer programs. Enclosed proposal copy[3] outlines method of approach.

3.13 Research on Computer-Augmented Information Management
Contract AF 19(628)2914
Air Force Systems Command, Electronic Systems Division
Bedford, Massachusetts.

[1] Copies of references 1 thru 4 are enclosed.

The objectives and method of approach for this project also are a direct outgrowth of the AFOSR-sponsored study. The project began in July, 1963, and proceeds at a $2\frac{1}{2}$ to 3-man level. Dealing only with software and system development (using hardware and basic software of the ARPA project), this project concentrates on improving the management of information involved in minute-by-minute, day-by-day and month-by-month problem-solving activity of a computer programmer and of a research group. The developments of this project will be used and evaluated not only by programmers within the ARPA-project programmer-aid system (and hence by our own researchers in their programming activity), but by the growing list of researchers (of section 2.1) in our coordinated augmented-human-intellect program for managing their individual, group, and external-source working information. Again, improved management is pursued by integrating real-time computer aids with new language and data structures, and new methods and procedures, within a coordinated working system.

3.2 Large Information Processing Systems

3.21 The Institute designed for the Air Force (Air Technical Intelligence Center), a comprehensive system for the systematic acquisition, abstracting, translating, dissemination, review, storage, and retrieval of a significant segment of the open-source foreign scientific literature. During the course of this project a comprehensive review was made of the operation and techniques of several of the largest technical information files maintained by the Air Force and other government agencies.

3.22 Another project which was completed after a two-year effort was the design and implementation of a complete data-handling system for an aerial reconnaissance project (ULD-1 Electronic Recon System - Contract AF 33(604)17231. This effort included system studies, computer selection, installation planning, program writing, and assistance with the final system test. For this project, a large data processing system was installed at the Institute for the programing and testing effort, and subsequently delivered to the client as a complete, operating system. Some special-purpose equipment such as magnetic tape converters, and special man-machine operator consoles were also developed as part of this program.

3.3 Miscellaneous Projects Related to Large Information Processing Systems.

Several related projects have been conducted by the Institute in various phases of the technical information problems, both in gross and specialized aspects of data handling, storage, and retrieval.

The following is a partial listing of these:

Technical assistance in implementing STEP (Scientific Technical Exploitation Program) as a systematic means of reviewing technical literature and identifying important material.

A graphical data processing study, which considered the handling of raw data, identification, programing, selection, indexing, storage, access to storage, and presentation.

Investigation of the feasibility of constructing a special file for the retrieval of information--a file to contain descriptions of up to two million documents with the capability of indicating simultaneously all documents related to an inquiry.

Development of an information system to aid in controlling the leadtime of a variety of significant military research and development projects.

Development of a technique for high-speed automatic reading of printed alphanumerical material.

Development of the Videograph printer for the transfer of video images to paper.

Development of high-speed document handling techniques.

Research to develop a system of materials suitable for draftsmen to use in making original drawings which would be reproducible by transmission photocopying.

Mobilization planning studies for various agencies with the DOD, which considered detailed manufacturing problems and the transition from drawings to hardware.

Procurement planning and control studies, including major activity on the "Missile Manufacturer's Planning Report."

Studies of storage means for graphical data, including microfilming.

Studies on the encoding of data in operational situations.

Another project on which the Institute provided assistance was the design of the data processing and file portions of a bomb-damage assessment system for the joint military services. This very large information handling system will maintain a current status record of all items of military potential (weapons, ships, bridges, etc.) on a global basis. The system has necessarily been designed with methods of rapid file maintenance and the incorporation of special communication and display equipment. For this project the Institute also assisted in the selection of the data processing and auxiliary equipment.

3.4 Multiple Instantaneous Response File --MIRF RADC Contract AF 39(602)-2772

The basic MIRF unit has been developed as a complete system for retrieval of document index information, and need not be connected to a computer. It includes an operator console with electric typewriter, paper-tape punch and other display facilities. The unit also includes two separate associative memories, one a dictionary and the other the file of indexing information for ASTIA documents. The indexing information for each item in the file includes the explicit serial numbers for eight descriptors, the explicit accession number of the document (file item) and an 80-bit single-field superimposed search code of the relevant descriptors. In use, the operator types in the descriptors in English for his inquiry. The dictionary permits a unique match and generates the coded serial number of the descriptor or informs the operator that it is a non-allowed indexing term. A search question, for the File, is derived by superimposing the codes of the desired group of descriptors. Generally, the number of descriptors used in a search question will be less than the number in a document. When this search question is complete, the File is quizzed in parallel and an immediate indication is given if any file items logically include the quizz. The unit permits and can handle multiple responses. Thus, following a "yes" response the number of documents is displayed to the operator. If the quantity is satisfactory to the operator, the indexing information on each responding item is then typed out.

3.5 Graphical Data Processing Research Study and Experimental Investigation

Contract DA 36-039-SC-78343

U. S. Army Signal Supply Agency, Fort Monmouth, New Jersey

This program has as its goal the design and construction of prototype equipment with a capability to learn to recognize certain features in maps, photographs, or other visual data. It is envisioned that the machinery will consist basically of two parts. The first part will be a fixed logic machine designed to filter the optical information and produce an output which is invariant under certain known transformations of the input (e.g., rotation, translation, size, noise, etc.). The output of the fixed part of the machine will preserve information relating only to the essential features of the input pattern. Various methods of optical sampling have been devised which together with implementations of certain theorems from Integral Geometry will prove useful in this first part of the machine.

The second part of the machine is the part which actually learns. It will be a network of interconnected elements called threshold logic elements whose thresholds and interconnecting weights can be modified. The machine training is then identified with the judicious changing of these weights and thresholds to produce useful outputs. The machine's memory of the essential features of the distinction between various patterns resides distributed among all of these weights and thresholds. Since the memory is distributed and not totally dependent on any one component, such machinery promises to be highly reliable even though parts of the equipment may fail. The main areas of research are in (1) methods for selectively modifying the weights and thresholds and (2) components out of which to build the threshold logic elements and weights and components for the fixed logic part of the machine.

DRC/hh
9/25/63

Reprint from Proc. of the Eighth Annual Convention of the Society of Technical Writers and Publishers, pp. 57-65

1961

THE BEGINNINGS OF AUTOMATION OF TECHNICAL DRAFTING, WRITING, AND EDITING FUNCTIONS

by Charles P. Bourne
General Systems Department
Stanford Research Institute
Menlo Park, California

Automation in drafting operations utilizes photocomposing systems for the "typing" of drawings. It is feasible that pattern-recognition equipment may be able to interpret hand-drawn sketches and compose them into finished standardized drawings. In the writing functions, data processing equipment is used to compile concordances, bibliographies, abstract collections, title bulletins, indexes for manuscripts, and other listings. Machine techniques which have been used to analyze legal statutes may conceivably be applied to technical documents.

INTRODUCTION

There is an increasing need for methods or techniques to improve all aspects of the documentation of modern science and technology. These aspects include the work of the author, draftsman, editor, publisher, and librarian. The need for improvement stems from continuing pressures to maintain or reduce documentation costs* and to increase the speed of transmission of information, while maintaining or reducing manual and clerical effort. In addition, it is hoped that new techniques will provide new services to technical workers that potentially could increase their scientific and technical productivity.

In response to these pressures, there has been a steady development of techniques for the mechanization or automation of documentation functions. The developments have been possible primarily because of the general availability of digital processing equipment and the cleverness of a few people who have found ways to use the equipment, and related equipment, for some of the documentation tasks.

This paper will concentrate on the facets of the documentation problem concerned with the drafting, writing, and editing of scientific and technical material. A great amount of effort has been expended in the development of techniques for the mechanization of the storage and retrieval of scientific information, but here we are primarily concerned with mechanization of the *production* of useable information. Other aspects of the production function, such as the possibility of publishing in lesser-used media — microcard, microfilm, magnetic tape, and the like — are covered in other papers of this panel discussion.

In this paper, some techniques for the automation of drafting, writing, and editing functions are described; the paper concludes with a brief discussion of the implications of these techniques for technical writers and publishers.

*It is estimated that approximately 2 billion dollars per year are spent for documentation of our 40-billion-dollars-per-year military budget.

DRAFTING AND RELATED FUNCTIONS

A tremendous number of drafting and engineering man-hours are spent annually throughout the country in the manual preparation of engineering drawings, blueprints, schematics, flow charts, and similar documents. A few innovations have been used to augment the manual process — special templates, preprinted diagrams of common components, simplified drawing methods, and so on — but few techniques or systems have been incorporated to completely replace manual drafting. There are, however, some automatic techniques that have been developed.

One very interesting technique to mechanize the preparation of electrical schematic drawings uses a photocomposing machine with a keyboard that includes the basic electrical symbols. A freehand engineering sketch, drawn on specially ruled paper, is read by the machine operator, who then "types" the sketch on the photocomposer keyboard. The characters are exposed on a photographic film, and the drawing is composed from this sequence of symbols. Alpha-numeric descriptive material is composed on another film. A third film contains the title block. The three films are then superimposed to make the finished drawing or negative.

For organizations that write a large number of computer programs, considerable drafting work must be done to draw the flow charts that describe the operations of these programs. These flow diagrams, which may run to scores of pages for a single program, can be extremely complicated. Several successful computer programs have been written to produce flow charts or block diagrams automatically from a given list of program instructions. The programs even go so far as to label each box to show in summary fashion what variables were involved, what computations were performed, and what input-output equipment was used.

In industries where numerically controlled machine tools are used, the description of a particular part design may take the form of some equations and geometrical statements. Computer programs are available to take this descriptive information and generate the sequence of commands for the machine tool. In addition, programs are also available to take these geometrical or mathematical statements and generate an actual image or engineering drawing on a cathode ray tube display device for subsequent photographing and printing.

An extensive amouht of work has been done in the computer industry to completely automate the major portions of the engineering documentation functions that accompany the design and development of a digital computer. The decision to automate seems to stem from the fact that a large-scale computer is simply too complex to document and control with manual methods, and that manual methods are too slow to be tolerated in an industry where the products are highly subject to technical obsolesence. Of course, one reason for automation efforts in the computer industry is that computer manufacturers have ready access to computers.

Design automation procedures in the computer industry incorporate the following types of semi-automatic functions that are concerned with project documentation and associated clerical tasks:

- Assign all wiring points, component locations, and other fabrication information to the schematic drawings.
- Prepare lists of parts locations and wiring information in such a form that an assembler can use this list instead of a drawing.
- Prepare system block diagrams from the logical equations.
- Route the wiring and prepare a wiring chart and cable listing in such a way as to minimize lead length, while at the same time considering loading and noise effects.
- Accommodate engineering changes to make updated lists and diagrams.
- Generate bills of materials for electrical components from the logic equations.
- Print logic block diagrams from the design information stores on magnetic tape.
- Prepare location charts for the placement of circuit cards.
- Check design errors. (For example, note that two lines from different sources have been given the same name, an improper component has been specified, lines are overloaded, etc.)

- Use the design information to generate cards or tapes for direct input into automated fabrication equipment.

The design automation process is costly. Some of the complete systems, for example, require as many as 120,000 program instructions. Nevertheless, many of the technical drafting, writing, and editing chores have been automated to the apparent satisfaction of the manufacturers.

The automatic generation, display, and printing of diagrams of chemical structures has also been accomplished with data processing equipment.

WRITING AND RELATED FUNCTIONS

It is difficult to find very many specific examples of the complete automation of the technical writing function, although there are many instances where the automatic generation of written material is part of a larger process. One writing task that has been almost completely automated is the preparation of concordances. An exhaustive concordance of the Bible, which required 30 years of effort, was first published by James Strong in 1894. In 1955, a 2000-page concordance of the Bible produced with data processing equipment [illegible]uired approximately 150 hours of computer [illegible]e. In 1959, a 965-page concordance to the poems of Matthew Arnold, prepared by data processing equipment, required approximately 40 hours of machine time. The study group that prepared the Matthew Arnold concordance states that this is the first of a series of concordances to be prepared with data processing equipment and published by this group. Data processing equipment was also used to develop a concordance to the Dead Sea Scrolls.

A group of scholars and theologians in Italy is presently engaged in preparing a complete concordance of the *Summa Theologica* of St. Thomas Acquinas by means of a punched card system. It is estimated that manual indexing of the complete works of St. Thomas (which contain approximately 13 million words) would take 50 scholars 40 years. The procedures employing punched cards will produce the indexes and concordances in a considerably more accurate manner in about four years with 10 scholars. Employing high-speed, large-scale data processing machines, the time required could be cut to less than a year.

Concordances indicate the places in the text of [illegible]ody of work where particular words were used, as well as showing a small amount of the text material which preceded and followed the particular words. If the adjacent text material is omitted, then the concordance simply amounts to an index to the terms used in the text. It is easy to see, then, that the first draft of a detailed index to a corpus of text material can easily be obtained automatically. For purposes of word analysis, the same process could provide a list of terms for the subsequent manual preparation of a glossary or dictionary. Ignoring the practical problems of getting the material into machine-readable form — problems that are complex, but by no means insurmountable — this type of program would be very useful for quickly and automatically generating first drafts of comprehensive indexes during the preparation of a manuscript for publication.

Data processing equipment has also been used to construct and update bilingual word dictionaries, primarily for application to machine translation efforts. As a matter of fact, machine translation may also be cited as another example of automation of some technical writing functions. The present status of the work in machine translation is well described in a recent report of the U.S. House of Representatives.

The preparation of bibliographies or abstract collections, which may be considered a writing function, has been completely mechanized in some instances by the use of data processing equipment or other special-purpose equipment to search files of information and prepare lists of references or abstracts of all the material that is relevant to the search criteria.

During the last five years, there has been an increasing interest in techniques for automating indexing and abstracting functions. Although automatic indexing has been attained with a moderate amount of success, it seems likely that writers and editors will be able to surpass machines in the art of abstract preparation for a good many years to come.

But the machines are making progress. Indexes to conference proceedings have been organized and prepared for publication by semiautomatic means by several organizations. Several technical journals are using machine techniques to semiautomatically write and compose title bulletins for publication. *Chemical Titles*, for example, publishes twice monthly a semiautomatically produced bibliography of approximately 100 pages, listing about 3000 articles from about 550 chemical journals.

Machine methods have also been used for composing material for publication. Computer or punched card equipment has been used to generate publication material (e. g., *Index Chemicus*) and listings of many kinds (that is, telephone directories, parts catalogs, computer program listings) which are then used to prepare the reproducible or master print for publication. In these examples, the printed lists from a tabulating machine are used for subsequent reproduction operations. Photocomoposing equipment is also being used to compose similar listings, and even continuous text material, for publication — for example, procedures manuals. Some serial publications such as the *Index Medicus* and *Nuclear Science Abstracts*, are currently being prepared by this method.

A few other current activities that are related to this discussion are the automatic writing of music and television plays; the automatic writing of detailed computer programs from specified tasks (that is, a computer is told to write a specific program by itself); and the automatic compression or abbreviation of natural text material. Some work has even been reported recently on computer programs to systematically generate lists of pronounceable 3- and 4-letter words. In this case, in the interest of good taste, the output was given a certain amount of editing by ordinary humans.

EDITING AND RELATED FUNCTIONS

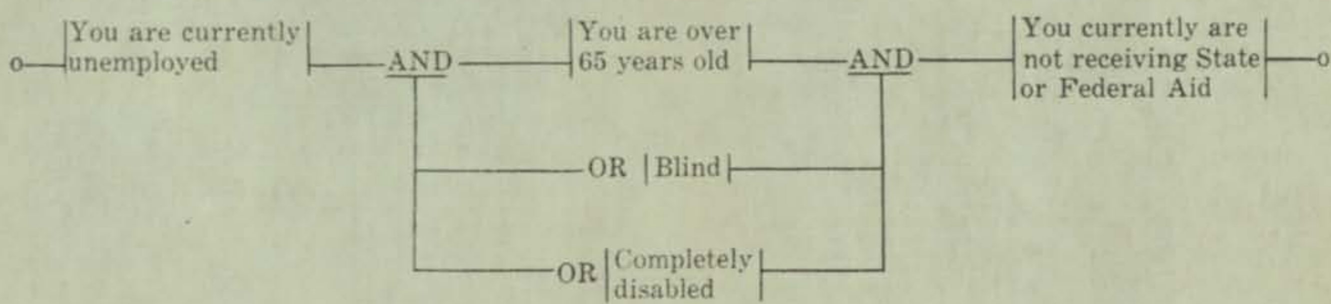
If the routing of published information to the potentially interested parties is considered part of the editor's task, then it can be said that some mechanization has been achieved in this area. Techniques have been developed for a machine system to semiautomatically maintain "interest profiles" for a large number of people, and route incoming material only to those individuals whose profiles indicate interest in particular subject matter.

Several research projects have mechanized some editing functions by doing such things as automatically extrapolating and filling in missing words in text material, and automatically inserting spaces where words had run together. In one instance, 4200 words of text material that had been squeezed together were expanded automatically back into text form with a correction rate of 99.7 per cent.

Andifyoustoptothinkaboutitthisisaprettydarn goodrate.

Very interesting methods have been developed — primarily by Laymen E. Allen of the Yale Law School — for analyzing legal statutes by breaking them down into schematic logic diagrams to show their basic meaning. A very simple example of this conceptual simplification is given by the following fictitious statute:

You are entitled to County unemployment benefits if*:



*If, that is, you can successfully pass through the network. The statute in text form might read, "You are entitled to County unemployment benefits if you are currently unemployed and if, in addition, you are over 65 years old, or blind, or completely disabled, and if, in addition, you are not currently receiving State or Federal aid."

It would seem unnecessary to employ machine techniques to analyze a statute as simple as this example. However, as everyone knows, there are many statutes that are virtually incomprehensible, often with single sentences that run for a page or more. Information processing techniques are currently available that might be able to make sense of these incomprehensible statutes, without the help of a Philadalephia, or any other, lawyer. Consider a semiautomatic editing system in which legal statutes drafted for legislative bodies are first submitted to a machine editor to generate logic diagrams of the form illustrated above. The logic diagram could then serve as a "check print" for the person who drafted the legislation, to make sure that the text actually says what the draftsman really intended to say (or, if the legislator wasn't quite sure what he had in mind in the first place, the logic diagram might help him pull his thoughts together). Once the thought and the formulator of the thought were in agreement, the diagram could accompany the text and be published with the text so that anyone who had occasion to read the statute would have it presented in a very concise and unambiguous manner — a consumation devoutly to be wished.

It may well be that commercial publishers will soon find it profitable to publish manuals of diagrams such as these to accompany the publication of laws or discourses on active fields of legislation — particularly tax legislation and the rulings of the Federal regulatory commissions. Anyone who has ever tried to penetrate the farther reaches of these legal jungles ought to be happy to pay a fair amount of money for a moderately good map.

It is unreasonable to expect complete coverage of all of our statutes in the near future, for the magnitude of the task is staggering; it is estimated, for example, that, in 1960, approximately 14 million words of Federal statutes were published. However, machine analysis of legal statutes seems to hold great promise for the future. And if machine analysis can simplify ambiguous or needlessly complex legal documents, there is little reason to believe that the same approach cannot someday simplify ambiguous, needlessly complex, or ill-thought-out technical documents.

IMPLICATIONS OF THE AUTOMATION OF INFORMATION PRODUCTION

It is unlikely that the growing automation of information production will throw many publication specialists out in the street — at least in the near future. At the moment, data processing equipment is superbly fitted for exhaustive, but essentially mechanical, tasks. It will undoubtedly be many years before machines acquire capabilities akin to human judgment, discrimination, and creativity.

Things may change, though, in our lifetime. Computers can compose music that is as intricate and difficult, if hardly as good, as that of Bartok and Stravinsky; they can write TV scripts that are not much worse than many of the shows on the air; they can now beat almost any of us at checkers; and they are beginning to play a pretty good game of chess — better than most beginners play. It is possible that the day may come when machines will be able to take a manuscript — or even the raw data — from a scientist or engineer and turn out a fairly respectable technical document, complete with illustrations.

But producing a complex report by machine is probably in the relatively distant future — perhaps 15, 20, or 30 years away. At present, writers, editors, and other publication specialists should learn how and in what circumstances the techniques described can be used to advantage in the near future; they should be aware of what machines can do and of what human workers must contribute to a man-machine system.

For example, special methods of writing and editing may be required to take advantage of the automated systems described, as well as for some of the newer mechanized systems, such as teaching machines. In addition to the change in processing techniques, it should also be recognized that there will be changes in the actual media of publication. That is, there will be an increased use of such things as magnetic tape, microfilm, paper tape, microcards, and other forms for direct publication and dissemination.

Specifically, it seems likely that drafting operations will see an increase in the utilization of photocomposing systems for the "typing" of drawings. In addition, it is not too unreasonable to expect pattern-recognition equipment that can look at simple hand-drawn sketches, interpret them, and then compose a corresponding standardized, finished drawing. Electrical schematics, block diagrams, and chemical structure diagrams would be likely candidates as input material for such a system. Processing equipment can also be envisaged that accepts a series of functional statements and then generates block diagrams to represent such things as organization structures, communication networks, and block diagrams for electrical and electromechanical equipment.

The writing functions will see increasing automation of the abstracting and indexing operations. This will include the compilation of bibliographies, the composition of title and abstract journals, and other lists and directories. Automation techniques will be used to prepare indexes for manuscripts prior to publication. And in addition, concordances — which have been used to date primarily by linguists, philosophers, and theologians — will start being used in abbreviated form for such practical purposes as guides to textbooks, instruction and procedures manuals, tax guides, and legal literature.

There is a very real possibility of initiating some mechanization of the editing function. It is possible to perform many copy-editing functions by a table look-up operation (that is, standard forms for abbreviations and journal citations, correct spelling, approved terminology). Consequently, some of these functions could be mechanized. It should also soon be possible to do some editing (for form, not content) with data processing equipment in much the same manner as that employed with machine translation, using rules of grammar and word dictionaries. The automatic preparation of routing or distribution lists may be achieved by the maintenance of "interest profiles" of a population of readers. In addition, text material may be reviewed and analyzed to construct basic logic diagrams in a semiautomatic manner for application to such things as legal literature and procedures manuals.

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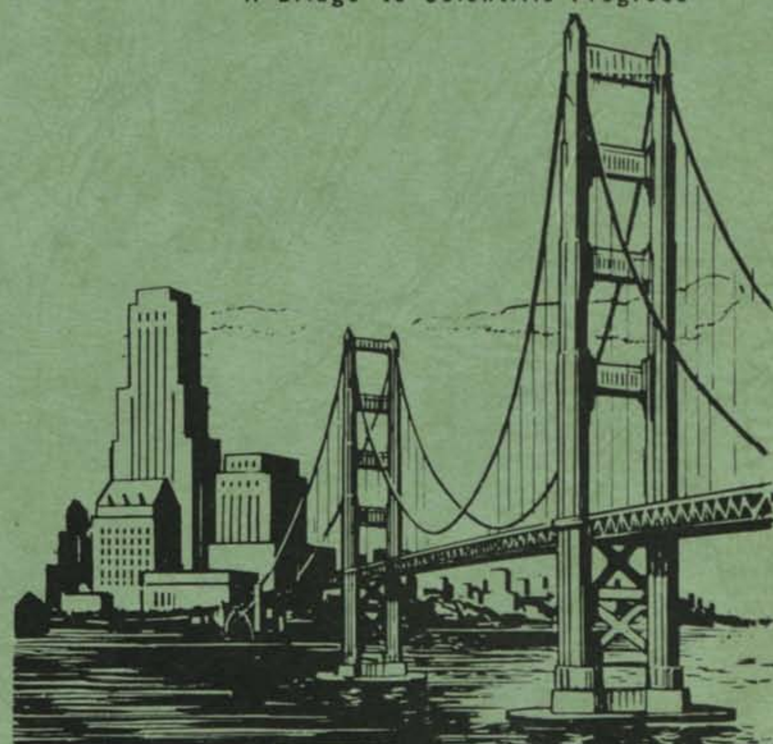

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CONTENTS

KEYNOTE ADDRESS

THE TECHNICAL WRITER'S SCIENTIFIC AND MORAL RESPONSIBILITIES IN COMMUNICATING WITH THE LAYMAN

by Harold G. Cassidy
Professor in Chemistry
Yale University
New Haven, Connecticut

Professor Cassidy compares STWP's role today to that of Benjamin Franklin who combined scientific activity with public service. Extending the comparison, he suggests a program of high responsibility and ethics based on individual behavior in educating and informing the layman, both national and international, as to our scientific enterprises.

My function, as I understand it, is to speak to the aims of your Society, and to the theme of this Eighth Convention.

From the information sent me by Warren Deck about your society, I learn that your aims include the development of standards, the development of a code of ethics, and the development of a philosophic basis for your activities. What I have to say will bear upon all three of these aims. I will, in the course of my talk, remind you of the first great American technical writer and publisher, Benjamin Franklin. He lived in troubled times, as we do. He faced much public apathy. He was able to combine in a most felicitous way, scientific activities of high caliber with distinguished public service. He wrote scientific articles for technical journals as well as pamphlets and essays for laymen. He published a newspaper as one of his many activities. He in himself embodied what we in our more complicated and specialized times would like to accomplish through our joint action as a Society.

We all had to read Benjamin Franklin's *Autobiography* when we were children. To most of us at that time, I venture, it seemed dull and out-of-date. But I believe that now, if we returned to it as adults, we would find it full of mature wisdom. Perhaps such a re-examination would recommend Benjamin Franklin to this Society as a prototype of the Technical Writer and Publisher.

I propose to present you with my thoughts on these subjects as they relate to my title. Since time is limited, and my objectives are ambitious, I am going to ask you to lend me your imaginations and your active intellectual cooperation while I make an analysis, in what is perhaps an unfamiliar way, of your function in the complex system called the American Way of Life. I will use this analysis to support my talk, and in the process you will see how the theme of this Convention comes alive: Technical Communication — A Bridge to Scientific Progress. Essential parts of this analysis were suggested to me by a friend of long standing, Mr. Edward F. Haskell.[1]

The cybernetic diagrams I use are taken from an excellent nontechnical book on cybernetics by Pierre de Latil.[2]

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[1]Chairman, Council for Unified Research and Education, 400 W. 111 St., New York 25.

[2]Pierre de Latil, *Thinking by Machine:* A Study of Cybernetics, Houghton Mifflin, Boston, 1950.

II

Figure 1 represents the *behavior* which sums up to the American Way of Life. It represents a complicated system with input, output, and feedback. It is to be understood that since we are speaking here of *behavior*, not the physical phenomena themselves, our diagram is applicable to a whole class of such complicated systems, whether they be living beings or living cultures. (It applies also, of course, for the same reason, to such simple systems as thermostats and governors.)

Of all the infinite variety of input factors we make two classifications: the controllable and the contingent. The contingent factors are those over which we have no control — or essentially no control. In this category belong, among others, the factors legally classed as Acts of God. Among the controllable factors is our behavior as laymen. Here we all contribute because though we may be specialists as technical writers and publishers, we are at the same time laymen in other areas.

It is with this diagram, I think, that my first point becomes clear, and that the theme of this convention comes alive. The technical writer and publisher occupies a key position in the feedback circuit: sometimes as detector, sometimes as controller, sometimes, and most often, I should think, as a combination of the two. This is how his behavior acts as a bridge or, better, a channel. The traffic is active, and consists of information which is coded and decoded.

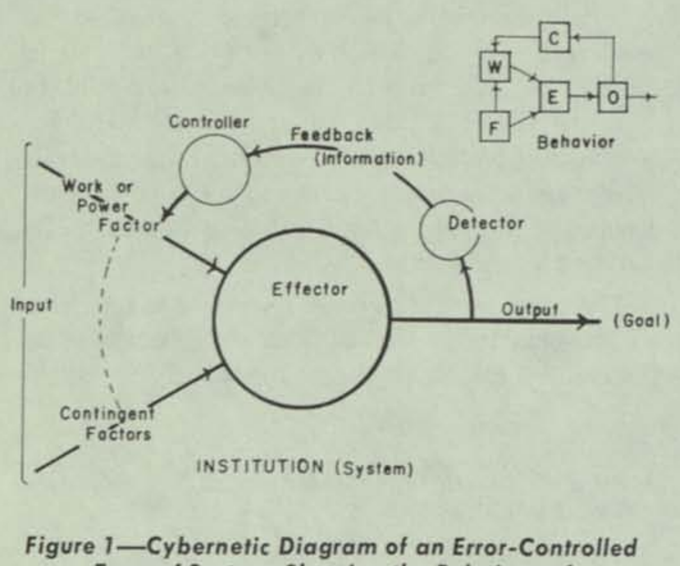
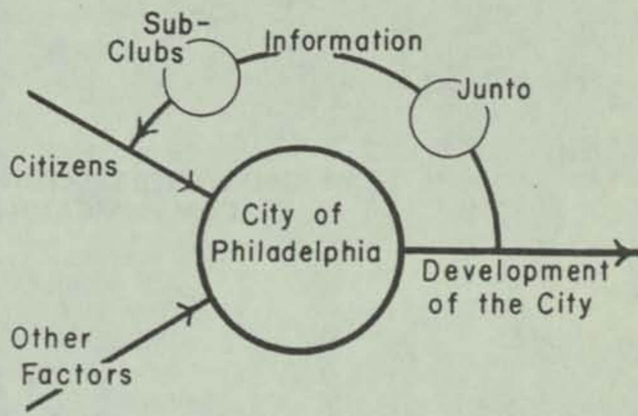


Figure 1—Cybernetic Diagram of an Error-Controlled Type of System, Showing the Relations of Input, Output, and Feedback



Benjamin Franklin's Philadelphia

Figure 2—Application of the Analysis Shown in Figure 1 to Eighteenth Century Philadelphia

It is evident, then, that his scientific responsibility in functioning this way is *to avoid distortion and to transmit the minimum of noise and the optimum of information.* I say optimum rather than maximum because we all know that pedantry begins on the other side of this optimum, and that it can clutter up the transmission with irrelevancies. His moral responsibilities lie in this, that *the direction of the output is dependent upon the values of the detector-controller.*

I will return to these two responsibilities later, and discuss them in some detail. But first, since this diagram is an abstract one, let us make it concrete by applying it to eighteenth-century Philadelphia: the Philadelphia of Benjamin Franklin. This fine illustration was worked out by Mr. Haskell, and he has generously permitted me to bring it to you. For this purpose we relabel the diagram to yield Figure 2. In this figure the output is the development of the city. The contingent input includes the weather; the factors beyond the control of the citizens which affected commerce; the nature of the terrain; the behavior of foreign nations such as Spain; and so on. The controllable input includes the behavior of the citizens, and other power-factors such as operation of currency, and so forth.

In his *Autobiography* we read that Franklin set up "a club of mutual improvement" called the Junto. "The rules I drew up," wrote Franklin, "required that every member in his turn should produce one or more queries on any point of morals, politics, or natural philosophy to be discussed by the company, and once in three months produce and read an essay in his own writing on any subject he pleased." The Junto was limited to twelve members, and it lasted upwards of forty years. Because many people wished to join, but Franklin wanted to keep it small and intimate, he encouraged the individual members to form sub-clubs. Five or six of these were organized, and contained a total of seventy to eighty members. The Junto and Sub-Clubs comprised the most effective (but by no means the only) components of the feedback cycle of eighteenth-century Philadelphia.

At the meetings of the Junto it was common, under the leadership of Franklin, to discuss civic problems from philosophic, moral, technological and economic points of view. Thus, policies could be discussed, as well as means for implementing them. The members of the Junto would thus have interesting topics to bring before their sub-clubs, and the members of these could talk about these topical matters in their own clubs, coffee-houses, and homes. In addition, through his newspaper Franklin could reach a large audience, and thus further educate the citizens toward some action deemed beneficial by the Junto. A reverse feedback also occurred in that the opinions of the public could be brought back to the sub-clubs and to the Junto by the members, and so influence them.

By the operation of this cybernetically sound system Franklin was able to get the streets paved, cleaned, and lighted. He was able to initiate and implement the founding of a library, a police force, a fire company, a militia, a school, a hospital, and what developed into the American Philosophical Society.

It is clear from this analysis that Franklin, his Junto, and the Sub-Clubs, acted as detecting and controlling members of the feedback circuit in the system called eighteenth-century Philadelphia. They performed the functions of evaluating the output behavior, of initiating policy, of transmitting it in understandable form to the public, and of responding rationally to public opinion. Moreover they were guided by Franklin's high moral principles, as I shall indicate. The result was rapid, and on the whole rational, development of the City of Brotherly Love.

III

As I see the function of the technical writer and publisher — that is of all of us, it is to operate within this feedback circuit for our Nation and for the World. Our activities will be a mixture of small and large acts. The times are very complicated, and we can't all be Franklins. But we can all contribute to this noble enterprise. Here we approach the question of our scientific and moral responsibilities. I can, of course, discuss only a small part of these.

One primary scientific responsibility, it seems to me, is that we must communicate the facts as truthfully as possible in language which is as clear and as free from the causes of misunderstanding as possible. That this will be a major theme at this Convention can be derived from reading the program. Further, every effort must be made to present the context as part of the truth. It has seemed to me that frequently technical writing, particularly for the public press, has promulgated error and failed in communicating the truth because of omissions of the whole truth, or of the context.

For example, in the cranberry "bog" of Thanksgiving, 1959, much misunderstanding and recrimination could have been avoided, it seemed to me, and as I judged from the questions of friends, if the reports had stated that the suppliers of the chemical aminotriazole were required by the Government to give directions for its safe use. Further, the question of toxicity could have been discussed not as an open or shut matter, but as a matter of probability. Since some members of the public are likely to be quite sensitive to the chemical, and these people are not able to be identified, then the question is one of withdrawing the contaminated product in order to save some lives.

In a case such as this we tend, I think, to forget our scientific responsibility to educate the laity. In a scientifically fast-moving culture such as ours, we need to keep the layman informed. The concept of a probability distribution in responses to a drug, for example, may be quite new to him. And we might profitably go so far as to drive home the lessons about individual freedom that this implies, as discussed so comprehensively by Professor Roger Williams.[3] We must be missionaries from Science, and we must operate on the principle that the education of the person, whether he is a layman or a specialist, is only *begun* in school and college; it should never end.

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[3]Roger Williams. *Free and Unequal: The Biological Basis of Individual Liberty*. University of Texas Press, Austin, 1953.

Another example is in the area of space activities. When the Russians put up a massive satellite, or a man in a capsule, it is important to give perspective while acknowledging the scientific feat. It seems to me extremely important, as part of any account of such an event, to point out that the objectives of the United States program in this area are to approach the solution of the outer-space problem through instrumentation wherever possible. It needs to be pointed out that we have orbiting more satellites than any other nation and are providing information; and, particularly, and *over and over again*, driving the point home, that most of the space information we get (that is, except the military information) is free to the world, so that in effect we are the research organization for the world, while the Russians, who are also doing much research, tell little or none of their results. Since they have access to all this information, they can concentrate more effort on political spectaculars. All this context and background should be given over and over again as an antidote to the Soviet toxin.

IV

The bridging, or channel, function of the technical writer and publisher is clearly bound up with the problems of communication, and it is about this matter that I want to talk briefly, now, because I have given it a lot of thought — particularly with respect to communication between the scientist and the nonscientist, or humanist. What I have to say applies largely to college-trained people like ourselves, but it can be extrapolated to the rest of the public.

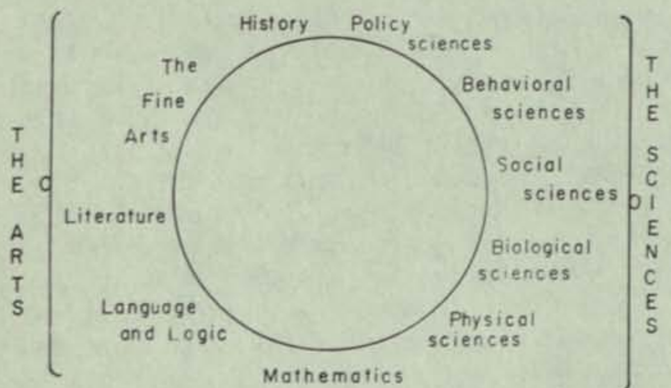

Figure 3—Definition of the Sciences and the Humanities

First, I will define what I mean by the sciences and the humanities (or the arts). This is done in Figure 3. I have taken the major disciplines or groups of disciplines as listed in a college catalogue and arranged them in the orderly fashion shown. The sciences are those indicated by the bracket; the humanities those so labeled. Overlapping occurs quite properly in the areas of Mathematics and History. Now let us use this definition to draw the diagram of the whole field of knowledge and experience shown in Figure 4. Here the circle of disciplines of Figure 3 is arranged around the equator, and serves to label segments of the sphere. The upper part is labeled philosophies, the lower technologies. You may rotate this diagram any way you want because I explicitly wish to state that no discipline is "better" than another; all are parts of a whole.

This diagram implies that the technologies bring together many of the more theoretical disciplines. We know that this is the case. The engineer brings together several sciences and a number of arts; the physician combines in his activities a whole galaxy of sciences and arts: chemistry, biology, psychology, and the knowledge of human nature which can be best taught through the humanities. One important function that this diagram serves, then, is to give you encouragement and support in a matter which I sense to be of considerable concern to you: the fact that in this society physicists sit with artists; engineers work with English majors. Be of good cheer! This is what

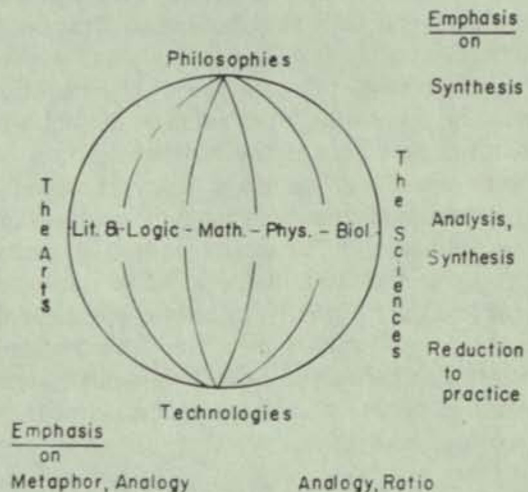

Figure 4—Diagram of the Body of Knowledge and Experience Which Is Taught in the University

helps to certify you as engaging in an engineering activity. Whether your activity has that status depends on the quality of the results. If it is essentially rote work, then it is a craft. But if you step out, if you do imaginative research on problems, and especially if you examine your own field so as to derive theories and general laws such as are implied in your aims, then your new field will have demonstrated the professional status of engineering. In my opinion engineering of all kinds, including the technologies that are derived from the humanities, form the bridge or channel between the sciences and the humanities. The engineer must be both scientist and humanist because he reduces the general, theoretical knowledge of the scientist (for example the theory of stresses in metallic structures) to the individual instance of a given structure (*this* graceful bridge over *this* river at *this* point for *these* human reasons). Thus your activity of reducing, or converting, theoretical knowledge to a form understandable to the layman can be an engineering activity.

The diagram of Figure 4 performs another function because it deals with means of communication, and shows part of your function in a broad way. The effort of the scientist is ultimately to speak entirely in the language of mathematics. This is an ideal which will never be reached, but is closely approached in some areas. In other areas the best that can be done at present is to communicate by the use of analogy. The ultimate mathematical expression such as that embodying a law of Newton's or Einstein's is a ratio. (This statement does not apply throughout mathematics but is sufficiently general for use here.) An analogy is an imperfect ratio: it is like an equation with several adjustable parameters, if mathematical, or it may be verbal, or pictorial. Oftentimes — indeed usually — it has to be stated in the jargon of the profession so as to give it as much precision (qualitatively and quantitatively) as possible.

The layman and the humanist are generally not used to thinking in these terms. They often have to say such difficult things — think of a great novelist or dramatist trying to communicate nuances of character, or a poet trying to communicate a highly subjective feeling — that while analogy is their usual tool they have to turn for these purposes to metaphor. This powerful tool, used by all great novelists, poets, and painters, enables them to communicate the ineffable, the — so to speak — incommunicable. This is what makes them great and is the reason we turn to them for enlightenment and help. Thus we have the gamut from cold precise ratio which at its best communicates the ultimate in quantitative precision, through analogy to metaphor which at its best can convey the ultimate in qualitative precision. Your scientific responsibility includes, it seems to me, the creative function of imagining, inventing, learning, and teaching how to move from one part of this gamut to the other, in either direction, so as to bring understanding to both areas. I will not go into this matter further here since I have dealt with it (but not in this specific context) in some detail elsewhere.[4,5]

V

Perhaps we need to give most attention to our moral responsibility. There is, I know, a body of opinion which says that science has nothing to say in this area. This opinion originated over two centuries ago, when in order for scientists to be able to get together and talk amicably, all discussion of moral and religious matters had to be banned. The state of religious fanaticism in the world was such that, as Arnold Toynbee and others have emphasized, the Royal Society turned away in revulsion. The situation in America was enough different that Franklin, as we have seen, could encourage such discussion in his Junto.

It is the opinion of many people, nowadays, that we are reaping the fruit of this severance of the sciences from the arts, or humanities. Our cybernetic analysis indicates that we deal with a system which is controlled by feedback. This feedback may be inspected at many levels. But at its highest, most abstract and controlling level, we come upon a great truth which is preached by all the great religions if one examines their teachings and translates them into common language. *The direction of the system is controlled by values.* The values of a culture determine what is considered moral; what is right or wrong, good or evil. It seems to me quite beyond argument that science and scientists cannot be severed from the connection with values and morals.

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[4]Harold G. Cassidy, "The Problem of the Sciences and the Humanities. A Diagnosis and a Prescription." American Scientist, *48*, (1960) 383.

[5]Harold G. Cassidy, *The Sciences and The Arts. Their Relationships in Education and in Life.* Harper and Brothers, New York (in press).

This, I think, is something that Franklin saw quite clearly, and practiced. You recall his Art of Virtue by which in a very practical way he tried to improve himself with respect to thirteen virtues, to be practiced in a balanced way: temperance, silence, order, resolution, frugality, industry, sincerity, justice, moderation, cleanliness, tranquility, chastity and humility. You recall, also, his projected great enterprise, a United Party of Virtue, which would act for the benefit of all mankind.

It was no accident that Franklin and his Junto accomplished so much for Philadelphia. What they did was highly constructive since it benefited not only them, as business and professional men, but the whole community. This required high moral character, and the kind of circumspect behavior that I think is the duty and responsibility of each of us because of our position in that feedback cycle. You recall his caution to young printers:

> "In the conduct of my newspaper I carefully excluded all libeling and personal abuse, which is of late years become so disgraceful to our country. Whenever I was solicited to insert anything of that kind and the writers pleaded, as they generally did, the liberty of the press, and that a newspaper was like a stage-coach in which anyone who would pay had a right to a place, my answer was that I would print the piece separately if desired and the author might have as many copies as he pleased to distribute himself, but that I would not take upon me to spread his detraction; and that, having contracted with my subscribers to furnish them with what might be either useful or entertaining, I could not fill their papers with private altercation in which they had no concern without doing them manifest injustice. Now, many of our printers make no scruple of gratifying the malice of individuals by false accusations of the fairest characters among ourselves, augmenting animosity even to the producing of duels; and are, moreover, so indiscreet as to print scurrilous reflections on the government of neighboring states and even on the conduct of our best national allies which may be attended with the most pernicious consequences. These things I mention as a caution to young printers and that they may be encouraged not to pollute their press and disgrace their profession by such infamous practices, but refuse steadily, as they may see by my example that such a course of conduct will not, on the whole, be injurious to their interests."

VI

In conclusion, then, I offer you a program. Bear in mind that all good action that is lasting depends on individuals. That an organization have a code of ethics is irrelevant unless the large majority of its members show *by their behavior* that they believe in it: unless they individually abide by it. Thus the responsibility, like so many important ones, is a personal one.

My program is that we never forget our high responsibility to our country as detectors, controllers, and transmitters of knowledge of all kinds;

That we always try to speak the truth, and all the truth, including that about limits of certainty;

That we endeavor always to include the context, because truth is one of those things that changes its appearance with a change in context;

That we always remember that because of the cybernetically closed nature of our society every action of ours has repercussions — feeding back upon ourselves and our community. A good act, a right behavior, makes it easier to do another;

That we be circumspect. That is, that we exercise judgement in the knowledge that true liberty is the liberty to do that which is right;

That we exercise foresight because we know that this feedback circuit operates; that we continue in time — and few actions are of solely passing importance.

The evil that men do does live after them. But the good may have a longer life.

When in doubt let us ask ourselves what that first great American technical writer and publisher, Benjamin Franklin, would have done in our place.

GENERAL SESSION

A SCIENTIST LOOKS AT THE PROBLEM OF TECHNICAL COMMUNICATIONS

by Charles M. Mottley
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Stanford Research Institute
Menlo Park, California

The technical communicator will have to be on his toes to keep up with the changing technological scene and thoroughly learn the specialized scientific and engineering language which he translates for the benefit of readers. To cope with the great volume of technical information and its complexity, he might take a cue from electronic data processing systems.

As I look at the problem of technical communications, I see many problems rather than a single one. It would seem to be worthwhile for us to examine some of them this morning.

As technical writers and publishers you form an important part of what has become known as "the industry of discovery." You are, so to speak, stationed along a production line. One of your main functions is to help move the product along the line. The "product," in this case, is the knowledge that is produced in the different stages of development and engineering research. Your function in the production process is to transform science and technology into the language of utility — which is essentially the language of common sense. This is an important function because knowledge that is badly packaged in an obscure form, or is retained in somebody's head, is not very useful information. It is, indeed, as frozen and useless as the icecap of Greenland.

I am reminded of the French scientist, Gley, who conceived the idea of insulin at the turn of the century. He wrote it up and placed it in a sealed envelope in the Academy of Science; then when the Canadians — Banting, Best, and McLeod — published their findings in 1922, Gley came forth and claimed prior discovery. The Canadians' work resulted in an important treatment for diabetes; Gley's secret was never used.

You are all aware that technology is undergoing rapid change, but I wonder how many realize what these changes will mean to you and your profession. You should not allow yourselves to become trapped by the notion that you are limited to being "writers" or "publishers"; if you do, this may be the low road to obsolescence. If you truly understand the function of communication, however it may be performed, this is the high road to better performance. As technical communicators, therefore, you are responsible for taking the knowledge produced by scientists and engineers and transforming it into information for useful purposes. Writing and publishing are but two of the functions needed to perform successful communication. The so-called "information sciences" and automation are now at work in your vineyard and profound changes in communication techniques are already taking place. As I look at technical communications, I see as the *first* problem your need for a thorough understanding of the trends in the state of the art of communication.

Another question is the problem of volume. The need for adequate methods of handling the great bulk of information is forcing a change in techniques. Within the past two decades there has been an explosive increase in the quantity of knowledge produced by science and technology.

Twenty years ago, the amount of money expended for R & D in industry was less than one billion dollars. Last year it amounted to ten billion. This year the total expenditures in industry, government, and in the universities and other institutions for R & D are expected to exceed 13 billion dollars. This does not include the amount for research in the "soft" sciences. Remember that the object of research and development is to produce knowledge and that this knowledge, in turn, must be transformed into a communicable form if it is to be useful. It is hard to grasp the meaning of 13 billion dollars worth of *new* knowledge, but let me try to clarify it.

This report that I have in my hand is a piece of knowledge that was communicated to one of our industrial clients; it is entitled, "Techniques for the Design and Utilization of Communication Networks." It is about an average size for one of our major reports, running to a little over 100 pages. We turn out about 100 of these reports every month. In a single year we use 12-1/2 million pieces of paper, or about 4 freight carloads, to convey to our clients the technical information that is generated at SRI. However, the research performed at SRI is only 0.2 per cent of the total R & D industry.

Now let us look ahead. By 1970, the total expenditure for R & D in industry alone is expected to be double what it was last year — that is, it should be in the neighborhood of 20 billion dollars. Some people believe that our channels of effective communication are already overloaded by what is called the "paper storm." If this is so today, how are we going to cope with the storm when the volume has doubled?

The problem we are facing is not caused by doubling the volume alone. Some segments of the R&D industry are expected to decrease, whereas others will more than double. In government we are witnessing a shift in emphasis from defense problems to those of the "old-line" departments. Health research, for example, is increasing rapidly and we can see such conservative departments as Commerce beginning to increase their research efforts. In defense, attention is moving from mass production of weapons toward custom built items. The days of the thousand-plane raid have gone. Now the same explosive force is carried in a single Polaris submarine. There is a renewed interest in military systems designed for limited war and in sensing systems for reconnaissance and surveillance. We shall probably see new weapons designed specifically for disengagement from the cold war. You will recall that when Grant and Lee "disengaged" at Appomattox, Grant permitted the confederates to keep their side-arms and their horses. Today we shall have to design weapons systems especially suited for ensuring our security under more peaceful conditions.

Turning to industry, there is a trend toward increased interest in some of the so-called "under-researched" industries. These are industries that spend much less than the national average for R & D. At SRI we are focussing attention on some of these—among others, the printing industry, the primary metals and metal processing, the transportation industry, and the food industry.

Because your futures are closely linked to industrial trends in R & D, I believe that it is instructive for us to mention, briefly, what the outlook is expected to be for certain manufacturing industries.

Outlook	Industry
Aircraft, Missiles, and Parts	Expected to double by 1970.
Chemicals and Drugs	Growth of R & D expenditures, already high, will slow to approximate future sales increases.
Electrical Equipment and Communications	Continued rapid gains in R & D spending.
Fabricated Metal Products	Relatively minor increases expected.
Food and Beverages	Profitable opportunities for more food processing research.
Instruments	Continued rapid growth expected.
Machinery	Expected to double by 1970.
Motor Vehicles and Parts	Moderate expansion expected by 1970.
Paper	Very rapid increases expected.
Petroleum	Expected to increase 114 per cent by 1970.
Primary Metals	Rapid gains expected.
Rubber	Moderate increases expected.
Stone, Clay, and Glass	Expected to more than double by 1970.
Textiles and Apparel	Expected to expand moderately.

Let us look for a moment at some of the problems to be found in the production line of the industry of discovery. First, on the input end, are those scientists who make the original discoveries and communicate their findings to their colleagues for crosschecking and confirmation, and establishing priority of discovery. Their language is often so specialized that it is scarcely intelligible to scientists in other fields, let alone to the applied scientist and the layman. Next, there are those rare middle men, the applied scientists who can comprehend the meaning of the basic discoveries and reduce them to practice. Then there are the engineers who transform the concepts, designs, and models into useful goods and services. Finally, there are the technicians who carry out the instructions; at best, they may have only a high school education, but they must be able to "read and execute," on the basis of written instructions, drawings, specifications, operating and maintenance manuals, and other sources of technical information.

In addition, we must not forget those who are responsible for the management of R & D. A thorough understanding of the implications of science and technology is necessary for decisions by managers of our military, government, and industrial enterprises. It is also important that the public and their elected representatives be properly informed in a free society. Then, there are the teachers in our educational system who must equip all of these people (scientists, engineers, technicians, managers, politicians) so that they can properly communicate with each other. The difficulty is that the students of today must be able to cope with things that have not yet been discovered or invented.

As we look at this extensive, dynamic production line, we find very serious gaps in the channels of communications between basic research at one end and the "consuming" public at the other. We attempt to overcome these handicaps pretty much as the Chinese did during the Korean War. You will recall that as the Air Force and Navy cut the North Korean rail lines, instead of waiting for crews to repair the tracks as we would, the Chinese simply mobilized their coolie labor and carried the supplies across on back-packs or A-frames. Our analogy breaks down at this point. Although we are carrying our communications across the gap on the A-frames of words, phrases, diagrams, and charts, there *is* an important difference. It is as if the rice had to be boiled during the transfer and delivered in cooked form at the other side. As I thought about this analogy I was not sure that technical writers would appreciate being likened to an A-frame with a built-in double boiler. However, some of you may feel that way when the heat is on to get out a document.

The technical communicator, nevertheless, has an important responsibility to expedite the flow of information. He must be able to grasp the intended meaning on the input side, have a good feel for what the traffic will bear on the output side, and make the transformation from one language to another during the operation.

Now the language of science is obviously quite different from the language of common sense, but the technical communicator must understand both. The transactions of science are conducted in precise symbols whose operational meaning is understood only by the initiated. Even the words employed by scientists and engineers are not the words of everyday usage, even though they may frequently look the same. I am sure that many of you are familar with M. W. Thistle's article, publisted three years ago in *Science*, in which he estimated that only one ten-thousandth of what scientists know actually gets through to the comprehension of the layman. If he had gone on to calculate how much of it was actually used by the layman as a basis for action, it would have been a very small fraction indeed. But even though only a small amount of information is expected to survive the journey across the several gaps, communicators have a vital professional responsibility to safeguard the meaning of the information. They must see to it that the meaning is not garbled, slanted, or lost in the course of the translation. This is indeed a very difficult problem and a challenge to the integrity of the profession.

Let us assume that the scientist, perhaps with the aid of a technical communicator, has been able to bridge the gap successfully and has reached the decision makers in top management. On the basis of the communication, it is decided that a certain action should be taken. Experience shows that much of the content of the message becomes lost as it is translated into action. A recent study reported by *The Iron Age* has shown that only two-thirds of the messages from top management are understood by the vice-presidents. At the general manager's level, the amount of information surviving is down to 56 percent. As it reaches the plant manager, the level drops to 40 per cent. Among foremen, it dips to 30 percent; and finally, among the workers, the rate of understanding is only about 20 per cent. It is very discouraging prospect for a technical communicator to realize that even if he conveys a perfect message, it will suffer such drastic attenuation.

Let us turn now to another problem. Science has made great advances as a rather loose collection of specialized subjects. As civilization came out of the Middle Ages, there was so much to be discovered by the scientific method that its practitioners moved away from the situation where one man could grasp all of "natural philosophy," to the condition of specialization which we have today. However, the problems of the real world, as opposed to the laboratory, are not specialized problems in single academic disciplines such as mathematics, physics, chemistry, or biology; they are problems requiring the combined talents of several disciplines. Certain interdisciplines, such as biophysics or biochemistry, have grown up with their own specialized languages, but we have no true multidisciplinary language. Unfortunately, our educational system tends to perpetuate the difficulty. Our scientists, engineers, and technicians are normally taught a few restricted subjects. Only rarely does the system produce anyone capable of penetrating the interdisciplinary barriers. Perhaps the biologist, who must understand something of the physics, chemistry, ecology, engineering, and mathematics of living organisms comes as close to it as anyone — provided that he, himself, has not specialized too much. I have observed that biologists frequently make good communicators of technical information. Perhaps it is because they are not as narrowly trained as those brought up in the other basic disciplines. Nevertheless, the confusion of tongues generated by our educational practices has raised a "Babel" barrier that is just as formidable as the sound barrier, the heat barrier, and the radiation barrier. The technical communicator who has successfully learned how to break down this barrier should receive a special plaque, especially if he can transmit the know-how to others.

Let me turn now to one final problem. This era is likely to become known as "the age of the augmented human." Human beings advanced about as far as they could with a built-in muscle-and-bone system of levers; and very little more material can be packed into the human skull, for obstetrical reasons. In short, we have gone about as far as could be expected with our anatomical heritage. So we have now augmented our capabilities with all kinds of machinery, computers, and control devices. Computers were all very well as long as we considered them as augmentations of fifth grade arithmetic, but now they are starting to "communicate" with each other in an esoteric language of their own. Self-repairing and self-maintenance features for electronic data processing devices are not too far away. Computers have long since become mobile instruments—we are working on miniature versions for space applications. If the engineers ever invent male and female computers, it will be the end of civilization as we know it.

Perhaps before that time arrives there will still be a period when these electronic data processing systems can teach us how to do a better job of technical communicating. In 1944 I was the leader of a team that used the Mark I computer at Harvard to solve a complicated statistical problem. It was the first application, a kind of Model-T. Nevertheless, that experience emphasized some of the basic characteristics of technical communications. When you "talk" to a computer, you have to have a very clear grasp of operational meanings. Further, you have to compress the messages. The units must also be stated precisely. You must know what kind of information is stored in the memory and how it is stored. You must be able to retrieve it as needed, and you must be able to recover the meaning and translate it so that the operators on the output side will perform the desired action. These, of course, are the characteristics of good technical communications, whether we are transmitting ideas on a person-to-person basis or programming a computer.

We are now on the verge of a large-scale effort to create data banks where information will be stored and from which it can be retrieved efficiently. We still have not learned how to store concepts or how to make concepts interact to produce new insights — but the time is not far distant. I believe that these developments are important to technical communicators and that you should keep "tuned in" on developments.

It seems likely that the solutions to the several problems of technical communications—the problems of the great volume of information, the complexity of the content, the translation of the multidisciplinary languages, the attenuation of meaning, the need for closer coupling, and, in general, the augmentation of the human—are going to be found, if they are ever completely solved, in computers and electronic data processing techniques.

Many of you may have to throw away the quill pen and learn the binary code. No matter what happens, you will still be faced with the problem of learning the language of at best one or two fields of scientific and engineering specialization, as well as the language of common sense. I doubt if our educational system will change in time to do any of us much good. You will have to do it yourself, if you wish to keep up with our rapidly changing scene.

THE LAST QUARTER-INCH

by Irving Kahn
President and Chairman
TelePrompTer Corporation
New York, New York

The need to penetrate and reach the brain of the user of technical information is spelled out by analogies and examples. The basic problems of communications are illustrated by such instances as the United States exhibit for the World Agricultural Fair at New Delhi, India, to which an American team — from anthropologist to semanticist — contributed successfully.

Since my remarks today are entitled "The Last Quarter-Inch," I hasten to assure you that I am not going to deliver a cigaret commercial.

Smoking is not the only place where quarter-inches are important. They relate directly to you and me. Your job, and mine, is to communicate. And nothing is so important in communications as the *last quarter-inch* — the quarter-inch of cranium a message must penetrate to reach the brain.

Communication is a much abused term nowadays. It is applied to such a potpourri of activities that it tends to become ambiguous. We communicate, of course, through all the senses — not only the spoken or written word, but also through applications of the visual arts — and even the senses of taste, touch, and smell. In addition to useful and nonuseful information, we *communicate* the measles and other pestilences. The actual means of communication may be as advanced as the bouncing of messages off a satellite, or nothing more than the lifting of an eyebrow. Even our computers "communicate," with humans or with each other, in a sterile sort of fashion.

So there are many definitions of that word — communication. But all fall short unless they take into consideration the factor of *the last quarter-inch*. In short, it is not enough to carry a message to Garcia. To be truly effective, we must be certain also that Garcia *understands* the message.

This is the mission of the technical writer. His is the vital responsibility of taking complex information and breaking it down into bite-sized chunks for the layman.

This also happens to be the mission of my company, and I hope to hold forth to you today both a challenge and an invitation. For I believe that the technical writer and publisher must be aware of — and be a part of — a sweeping evolution in the concept of Group Communications.

As the world grows more complex, we are fortunate to have at our command more efficient means of dealing with its complexities. For the task of communicating, we no longer are limited to any one or two or even a dozen tools. Just as the surgeon selects the proper scalpel or forceps for a particular operation, it is important now to select the appropriate communications instrument or instruments and to maintain sufficient flexibility that the instruments may be interchanged or combined or put to new uses.

What are some of the "tools" involved? The so-called audio-visual devices, of course (and what a cliche that is becoming) slide and strip film, and motion picture and television projectors, and magnetic tape, and whole families of highly sophisticated control and automation devices, yes; but more important than the hardware is the matter of technique — methods of making these instruments complement each other and do the bidding of the men they serve.

We are concerned at TelePrompTer Corporation with the application of electronics to the problems of communications — the new science, if you will, of what we call communitronics. We are interested in end results — the last quarter-inch — the message that is understood *and has the desired impact upon the person or group to whom it is directed.* We are committed to the belief that this can best be accomplished through the integration of *all* the tools of the communications trade *with* the accumulated wisdom of the ages.

This seems an appropriate time to say that I do not for a moment believe that the machine is winning the battle against man. I do not believe, for instance, that the so-called "teaching machine" will replace the teacher or the textbook — any more than movable type made handwriting extinct or television caused the demise of radio. Certainly the *functions* of handwriting and radio changed, but both still are important in their altered roles.

If you doubt it, remember that the radio — that's right, radio — broadcast of the Patterson-Johansson fight last month had a rated audience of sixty-two and a half million listeners. That's larger, they tell me, than any radio audience since President Roosevelt's early fireside chats.

Yes, functions do change. The teacher, the textbook publisher — and the technical writer, too — must face up to a changing world. Not to a loss of responsibility but to an acceptance of new ones.

The end product of improved understanding depends upon intelligent cooperation — cooperation among audio-visual engineers and electronics experts, and also, cooperation among educators and such seemingly strange bedfellows as the social anthropologist, the general semanticist, and the behavorial psychologist.

Let me illustrate. The training of military personnel for even the minimal assignments in missilry is no easy matter, as you know. A few years ago, it posed a grave problem at the Ordnance Guided Missile School at Redstone Arsenal. Of particular concern was the length of the training period in view of the relatively short enlistment or draft service cycle.

It seemed to Colonel H.S. Newhall, then the commandant of OGMS, that part of the answer might be the standardization of lecture material. He became interested in our quite well known television and public speaking TelePrompTer cuing device. Working with Colonel Newhall and his staff, we were able to help in the development of an electronic support program that proved to have historic significance.

Some of you may be familiar with this program, which was the first of its kind anywhere. Since then it has had considerable impact on other military training establishments and upon civilian educational institutions as well. The OGMS has concluded that the use of Group Communications equipment and techniques makes it possible — to quote an official report — "to improve the quality of instruction, improve retention on the part of students, increase flexibility of scheduling and, at the same time, capitalize on the abilities of highly specialized technical instructors."

How does the program work?

Each hour of instruction is carefully written in manuscript form and typed on video script for later use on the TelePrompTer reading units. Appropriate audio and visual training aids — including slides, film, and closed-circuit television — are planned and developed. All classroom effects are automated through the use of TeleMation, our company's system for automating presentation effects. Each effect occurs exactly on a word cue. The instructor need only read his script. Any event that can be controlled by an electric switch may be cued through TeleMation — control of classroom lights, slide changes, and so forth.

Original manuscripts are prepared by technical writers from a variety of sources. These include recordings of conventional classroom presentations, lesson plans, and pertinent reference material. Each script is carefully reviewed and edited to eliminate extraneous material, and to prevent the instructor from straying from his lesson plan. Training aids to support the presentations are designated by the technical writers — for example, a series of slides showing the buildup of electrical circuitry for a missile system. Not only are these certain to be technically and artistically acceptable, but they preclude unnecessary blackboard drawing by the instructor. Such slides or other projected material, incidentally, may be shown in sequence or may be placed side by side on a multiple screen surface.

The most important measure of such training is that students learn more in considerably less time and remember it longer. The OGMS also noted several important byproducts. Again I quote from an official report:

"In the administration of a large and complex school or training installation, it is important to note that, when courses of instruction have been prepared in final form using TelePrompTer and associated Group Communications equipment, the net result is a training package which can be used for that one occasion but, much more importantly, could be filed along with the appropriate training aids for future use. Future use might be an inexperienced instructor; or this training package could be taken elsewhere and, if required, could be presented by less experienced personnel . . .

"Another very important dividend is that scripts and appropriate training aids in this package form could very easily be made into the final galley proof for school textbooks or manuals or Department of the Army publications."

So there we have the technical writer and the publisher very much a part of a team that is doing some really exciting things in education. I might add that, from this beginning, our company now has equipment or systems in upward of seventy military and government installations. The fully-integrated system of today is vastly advanced from the early efforts at OGMS and, in addition to training, is being utilized for vital briefing and information control functions.

A great grandchild of the OGMS project went into operation this semester at the University of Wisconsin, and other major universities have projects underway or on the drawing boards. Within the next day or two, I expect an announcement of our retention by the Chicago Board of Education for an important assignment.

Industrial training and conference applications are still another area of vast potential and should particularly interest many of you here today.

Now, a short while ago I mentioned those "strange bedfellows" — the social anthropologist, the general semanticist, and the behavioral psychologist. Let me turn to another illustration to show why these are also *valuable* bedfellows in our integrated Group Communications concept.

One of our most critical Cold War ideological battlegrounds, as we all know, is India. This huge country stands out as a natural leader among the nations of Asia, and yet its own problems stagger the imagination. As part of the United States exhibit for the World Agriculture Fair at New Delhi, TelePrompTer Corporation was commissioned to develop a large automated instructional display for the Departments of State, Agriculture and Commerce.

Here the problem was not merely to break down agricultural information into terms that the rather primitive Indian farmer could understand. As an added complication, it could be expected that a majority of those who saw the display would be illiterate — unable to read even the simplest written material. Moreover, the spoken language is a confusion of dialects. Large numbers of those who came and saw would go away without having understood a single word of commentary given in English, Hindi, or any of the most prevalent dialects.

Obviously, pictures had to tell their own story. Hindi subtitles and taped commentary, provided in English, Hindi, and several dialects, would help. Basically, however, it was decided to depend upon a slide presentation on a large, billboard-sized screen. The slide treatment could be TeleMated at a pace slow enough that each picture could be studied and understood. Yet there would be sufficient variety to retain interest. Furthermore, a five-part screen would be used, allowing the story to be broken down into the simplest possible steps. As many as five pictures could be retained upon the screen simultaneously for cross reference.

So far, so good. But there were other considerations, and this is where our "strange bedfellows" came in. We would offend the Indians if we *preached* or *lectured* about American farming methods. We must work with colors and background music that would seem comfortable to the Indian eye and ear and would not distract attention from our message. And, finally, we must not unconsciously violate the taboos imposed by the country's complex religious, moral, and social codes.

For instance, a slide depicting a rural mail box had to be rejected. The photograph showed a vodka advertisement that would irritate abstemious Indians. Similarly, it was desired to emphasize that Americans are a religious people. Yet the question of identifying any particular religion was ticklish. Here the slide showed the interior of a church — obviously a place of worship but one which might have served virtually any form of religious belief.

This was the province of our social anthropologist, our general semanticist, and our behavioral psychologist — all called into consultation. The success of the final presentation, seen by more than a quarter of a million persons, was due unmistakably to a team effort.

The illustrations I have given you today have been, intentionally, of an unusually dramatic nature. But I would be disappointed if I did not leave you with the understanding that Group Communications techniques are being applied, right now, to a great variety of everyday projects in the armed forces, in education, and in industry.

And I want particularly to impress upon you, because your own futures are so vitally concerned, that the communitronics world is a new world — literally, a new frontier — with possibilities that we are only beginning to imagine.

For example, I was most interested a few minutes ago to hear an observation by Dr. Mottley. Technical documents, he said, are piling up so rapidly that it sometimes is easier to repeat research than to find the original and comprehend its meaning.

This is another area where communitronics can be — in fact, must be — of the greatest service. At this moment, we have, in some of our more advanced installations, devices that can store and make available for instantaneous random call-up as many as five hundred slides — along with appropriate taped-voice commentary. Such devices will perform a vital role in keeping strategic information at the ready in the Air Force command post now being constructed beneath the Pentagon. In another application, they are an integral part of the Information Control System installed for the commanding general of the Ordnance Missile Command.

These devices were developed for specific military purposes and only now are beginning to become available to industry. Their applications to the entire field of communications seems almost endless. Such devices may change the face of the library of the future and alter the very concept of research.

I have attempted in these few minutes to tell you very briefly some of the directions communications must inevitably take in the future. I will draw no conclusions. I hope I have stimulated your thinking sufficiently that you will draw your own. Perhaps I struck some of you at the outset as an enemy in your midst, about to tell you how a lantern slide and a roll of magnetic tape were going to replace you. I trust that will *not* be your ultimate conclusion. Yours is a relatively new profession. I am convinced it has a long and happy future — providing you are alert and prepared to grow with the challenges and the opportunities in Group Communications.

Whatever else may change, it is likely that the dimensions of man's cranial structure — *the last quarter-inch* — will remain the same. Whether that measures the thickness, or the thinness, of the ultimate barrier to understanding will depend in large degree upon you and me.

PANEL 1 — TRENDS IN INSTRUCTION MANUALS

MANUFACTURERS' PRODUCT SERVICE RELATED TO TECHNICAL DATA REQUIREMENTS OF THE AIRLINES AND AIR TRANSPORT ASSOCIATION SPECIFICATIONS (ATA-100)

by M. R. Callow
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The airline's view on product support is presented particularly in the area of service and overhaul manuals. In order to expand, the airline company must prove dependabilty with regard to safety and scheduling. Expansion of the airline company means increased markets for the airline suppliers. Therefore, it is in the best interests of the supplier to ensure that well written service and overhaul instructions are provided to support its equipment. The data requirements from equipment manufacturers are outlined along with their uses in the introduction of a new model aircraft. The publications requirements for aircraft equipment suppliers have been consolidated in the Air Transport Association's specifications ATA-100 to provide standardization of content and format, and a general discussion of this specification is presented.

It is my purpose to explain the necessity of good technical data in today's airline operation, and the responsibility of the manufacturer in supplying and preparing his technical data in conformance with airline requirements.

Any real problem is founded in something basic, as is ours. Our basic problem is to sell the seats we now have available for the traveling public. The trend, because of jet aircraft integration in 1959 and their greater lift capacity, is a more rapid increase in the available ton/miles over that of actual revenue ton/miles. To sell these additional seats we must tap a bigger market. We want to expand, and the area of potential is great.

As we are able to expand, this means to aircraft and component manufacturers more aircraft, more parts, and a bigger market for all of us. This is important to the manufacturers because the airlines becomes a greater portion of their market as the military requires less manned aircraft.

A sure way to sell is through dependability—Operate safely and on time.

This is where product support responsibility becomes a major factor in solving our problem. Most technical writers today in a work-a-day life represent a facet of their company's service organization which administers primarily to its publications and technical data requirements. Good publications and technical data are necessary if the airlines are to prove a product dependable. A product may be the ultimate in design and workmanship, but if not accompanied with adequate instructions on operation, maintenance, and overhaul, it is surprising how quickly it can be proved an unsatisfactory product.

Through operating experience we have established what is required from publications and technical data. We want you to look at this today, from our side. Try to see and understand it through our eyes.

If we are asking you to look at this problem through our eyes, it is important for you to understand how we operate. As an example, TWA's route extends from San Francisco, east to Bangkok. In operating this route, we fly daily the equivalent of twelve times around the world. Since I have been talking to you, there have been approximately fifteen take-offs on our system. Add the operations of United, American, Pan American, Delta, Trans Canada, and other scheduled airlines of the world, and then think of the exposure to problems, the technical excellence that we must have to ensure the degree of dependability and safety demanded by the traveling public.

With new aircraft costing 5 million each, we must equip well, we must be responsive to the problems with adequate trouble-shooting techniques, maintenance and overhaul data, specifications, and equipment. We must make the most extensive use of these expensive assets.

Short turn-a-round times and rescheduling of the Boeing 707 aircraft are necessary to maintain the high utilization and consequent earning ability of this airplane. These turns do not allow us to take all day to fix a problem that can develop. The old days of cut, fix, and try are no longer applicable.

This is why good instruction manuals are so important to us.

Many of you will say that these requirements are not new to you, that you have had experience with the military. The difference in the rate of accrual of flying hours between commercial and military aircraft is tremendous. Approximately four months of commercial airline flying is the equivalent of two years of military experience. With this kind of rate difference, the military experience cannot be used as a guide for commercial operators' experience. This kind of utilization really puts an aircraft and its components to the acid test. It will highlight good as well as bad. The manufacturer should provide complete maintenance, trouble-shooting, and overhaul data for his product in order that it may grow strong and healthy among its competitors.

Now, let's see how you can help. Here is my company's policy, and I am sure it is basic in others represented by ATA.

A SAFE AIRPLANE . . . Safety we all recognize as uncompromised and there is no need to discuss this item.

ON TIME . . . The biggest single factor in operating on time is reliability. Reliability is achieved through product service and product improvement.

AT A REASONABLE COST . . . Product price and product inventory are basic factors in a reasonable operating cost. Good technical data, properly used, is an excellent tool to help control the high cost of product inventory. Good maintenance and overhaul data is a major factor in obtaining optimum service life from a unit. If a unit gives full service, fewer spares are required.

Product price is to a degree a negotiable factor and an item which there is insufficient time to discuss.

The aircraft and component manufacturers have done an excellent job in lifting the state of the art to a level that makes our jet transports possible. They have rightful pride in a job well done. At this point their investment has been returned with profit, and they have good prospects for more business through sale of parts and future sales on new model aircraft.

Our work, however, as operators of the equipment, has just begun and the manufacturer's reputation and growth, and our future, depend on our successful operation of the aircraft in serving the public well.

All airline operating people cherish a dream of a push-button-controlled, trouble-free, and profitable operation. This, we feel, is the concept held by many of our passengers and some of our suppliers. This dream has nightmarish endings, when profits go down the drain with *High Operating Costs* or *Poor Reliability* or *Poor Performance.* Because of the importance of good maintenance and overhaul in the operation of a safe and reliable airline, I will take you through TWA's preparations, basically the same throughout the industry, for the introduction of a new model aircraft, from a maintenance and overhaul viewpoint, and show the important part in the picture played by the maunfacturers.

Our first need from the manufacturer is technical data:

1. Engineering Drawings
2. Functional Test Data
3. Overhaul Specifications
4. Maintennace Specifications
5. Trouble-Shooting Procedures
6. Wiring Diagrams
7. Illustrated Parts Lists

8. Tooling and Test Equipment
9. Service Bulletins
10. Revision Service for All Data

Such data provides the foundation of knowledge required for all of our planning.

Beside the basic aircraft there are thousands of units in the airplane that need individual treatment and care to ensure reliability. Optimum results are obtained from the best inspection, maintenance, and overhaul program that can be developed.

Such a program must cover—what to do—how often—at what locations.

As an example:

At the TWA Overhaul Base, located in Kansas City, we perform base overhaul, major modifications, and component overhaul.

At our Maintenance Bases at Idlewild, Kansas City, and Los Angeles we perform major maintenance, periodic checks, and engine changes.

At La Guardia, Midway, O'Hare, and San Francisco we perform minor maintenance and station services.

At all other stations in the United States and Overseas, we perform fuel service, daily service, and turn-around maintenance.

With the what, when, and where, goes the how. Methods and procedures must be developed when manufacturers' recommended procedures are not available, and this step is followed by preparing work cards and process sheets covering all routine and repetitive nonroutine jobs.

Then, we must develop job standards for all operations covering routine work, repair work, nonroutine work, unscheduled unit removals, etc.

We then develop a training program which includes Manufacturers' Classroom Training, TWA Classroom Training, and On-The-Job Training. We depend largely on the manufacturer for training material, training aids, and mock-ups.

We must develop tooling, hangar, shop, and line equipment requirements for all operations.

Then we develop changes necessary in shop and hangar facilities, or design and provide additional facilities for handling new requirements.

We develop spare allocation requirements, storage facilities, shipping, and packaging techniques for all rotatable units. Optimum packaging requirements must include these points:

Minimum size and weight
Maximum protection
Low cost
Re-usability

ATA Specification 300 has been developed to cover this important area.

We have now completed our proposed and optimum program for operating and maintaining our new aircraft fleet. However, before any airplane can be made operational by the airline we must obtain the Federal Aviation Agency's approval of our Maintenance and Overhaul program. Before receiving their stamp of approval we must prove to them that we have necessary supporting service in the way of instruction manuals, adequately trained personnel, etc., to maintain safe and reliable schedules.

When the manufacturers do a thorough job of supplying data, and otherwise supporting our program, this job is easy; but, frustratingly, it is not always so.

Let us look, for example, at our success in getting the necessary technical data.

Manufacturer A will not willingly give us required data, or is willing to provide it at an unreasonable cost.

Manufacturer B is willing to supply data, but never gets around to doing so in time to assist in our planning requirements, and, in fact, sometime not even in time to support our start of service.

Manufacturer C does not even extend the courtesy of a reply. After three or four tries we search out a top official of the company. I am sure that is as embarrassing to him as it is to us.

And then, there are a goodly number like Manufacturer D who gives us the complete support we need upon request.

All of you here today who are involved in the preparation of instruction manuals fit into one of these categories, and I am sure that your presence here indicates your interest in improving technical data service.

Inadequately detailed procedures can really give problems. Picture the poor mechanic with a unit containing 119 different piece parts trying to memorize the order in which he disassembled it.

Another area in which we encounter trouble is the lack of tooling and test equipment information. You would not try to hunt or fish without proper equipment, but consider a mechanic facing the prospect of overhaul of a complex unit without adequate instructions, tools, or test equipment. This is where we are countless times because of poor product service. Such problems are not conducive to the operation of a safe, dependable airline at a reasonable cost.

BUT GOOD PRODUCT SERVICE WILL CHANGE THIS PICTURE.

The preceding defines the importance all airlines attach to good technical data and makes clearly evident the responsibility of the manufacturer in supplying it to us if we are to believe in the integrity of his claim that he will provide good servicing of his product.

The ever increasing complexity of each issue of today's aircraft has precluded the manufacturer's theory of old that a man with a pair of water-pliers, bailing wire, and a little ingenuity can keep them flying. Unfortunately too many manufacturers yet consider this approach adequate, or so you would suppose from their concept of what is adequate in the way of technical data support of their product. A number of years ago it was apparent to the technical people of the airlines that today's aircraft and components could not be understood and maintained by airlines personnel unless the complexities and specialized handling requirements were adequately documented.

We considered that one reason we were not receiving adequate technical data from the manufacturer, and in a great many cases none at all, was that we had not made clear to the manufacturer what we required in technical data to reliably and economically maintain his product. We did realize that while our needs were basically common, there was variation in thought among the airlines as to what constituted adequate data for individual operating policies and requirements. This individuality was costly to both the airline and the manufacturer. We therefore reasoned that a need existed in the airlines industry for standardization of technical data if we were to obtain both economy and greater utilization. If we could standardize the definition of our needs, the requirement would be uniform throughout the industry.

Under the auspices of the Air Transport Association, the industry formed a study group to determine in which areas of technical data could standardization first be advantageously achieved. Results of the study disclosed that the data requiring urgent need of attention was in the instructions manuals area, and particularly in the handbooks dealing with maintenance and overhaul of the aircraft and its components.

Member airlines directed the ATA Engineering Division to commission and chair a committee to be known as the ATA Advisory Group for Technical Data. The Advisory Group, comprised of airline representatives, was directed to develop a standard specification for technical data required by the commercial airline, a specification acceptable unanimously throughout the industry.

The specification was to provide a standard for:

1. Required subject material
2. Definition of required material
3. Details and specifics required in subject material
4. Sequence of presentation of subject material
5. Presentation format that could easily and economically be prepared and maintained
6. A standard flexible enough to keep pace with the requirements of a dynamic industry

The first issue of the specification, identified as "Specification for Manufacturers' Technical Data," ATA Specification No. 100, was released June 1, 1956. To date, five supplementing and improving revisions have been released, and number six is in work. Many valuable manufacturers' suggestions have been incorporated in the specification by these revisions.

Unfortunately our specification cannot ensure us good technical data; only the technical writer can do this. The specification will however, leave no doubt as to what is basically required and provide an outline that, if followed, will generally result in technical data acceptable to the airlines.

If the technical writer understands his subject and will recognize the end use requirements of his effort, he can and will write simply and effectively.

In a recent address to the N.S.I.A. Maintenance Advisory Committee, Air Force Major General W. T. Thurman said, "Often when the scope of publication contents is satisfactory, their complexity leaves much to be desired." We concur in this observation. Words are valuable only when the listener or reader can understand and utilize them to his own benefit. Simplified and effective technical data is a must in our time-controlled operation.

This, then, is the responsibility of the technical writer. His position in today's field of technology is a very demanding one. He must be able to listen, to read, and to comprehend in the highly specialized intelligence area of design engineering. In addition, he must be able to translate his knowledge in brief but complete and readily interpreted language for the layman.

ATA Specification 100 was designed primarily for the layman, who, in our term of reference, is an airline mechanic. Airline mechanics are individuals of considerable intelligence, capability, and experience in the various mechanical fields. They are well trained, equipped with necessary facilities, and licensed by the FAA to perform maintenance and overhaul to the most exacting manufacturers' standards. All they require is adequate technical data, simply stated.

It is not feasible in time nor expense for the airline technical people to undertake the preparation of required instruction manuals for the thousands of units serviced and overhauled daily. Therefore, we must look to the manufacturer and his publications organization for required technical data as a part of Product Service.

Most manufacturers have accepted ATA Specification 100, which is recognized by the airlines industry here and abroad as the only acceptable standard for manufacturers' technical data. Further, it is known that the Department of Defense requested the airframe manufacturers who had submitted bids on a proposed new fleet of aircraft for the Air Force, to resubmit quotations for technical data prepared in accordance with ATA Specification 100 rather than Military Specification.

To those manufacturers who yet consider us captive customers, and have been reluctant to supply required technical data in accordance with our industry standard, I can only say, "Don't kill the goose that lays the golden egg." The airline industry will expand, but to do so, it must have good product service to operate efficiently. Consider us as the goose who does not want to die; who, if faced with danger, will fly to where he will be well fed and cared for.

Rather, I would suggest to all maufacturers that good product service, so necessary to both of us if we are to realize a common dream of profitable operation, is mandatory. Join us.

Our success as airline operators, and the reputation of the aircraft and component manufacturers, are governed and judged by the alertness and reliability of our performance. The confidence placed in our airlines by the traveling public must be earned. It cannot be achieved any other way. With good support, we *can* maintain the level of service which our customers deserve.

Poor sensitivity on the part of the manufacturer to properly support his product with good technical data can result in the anchoring of a $5 million aircraft to the ground, and with it, our reputation and his.

BETTER MILITARY TECHNICAL MANUALS

by Robert F. Harvey
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A technical manual study is being conducted by the Armed Forces Supply Support Center (AFSSC) the objectives of which are the standardization of military requirements, cost reduction, improved preparation and processing, on-time deliveries, and uniform quality control procedures. One of the results of the study is the concept of three manual types to provide different manual quality and content in accordance with its use with stable production equipment, production equipment with contemplated modifications, and developmental equipment. These manuals would be further divided to cover particular technical fields such as electronic equipment and aeronautical equipment.

What I hope to do is provide you with an understanding of the purpose of the Military Technical Manual Study being conducted by the Armed Forces Supply Support Center, the Army, Navy, and Air Force, the current status of this study, and a few of the major problem areas.

I have an ulterior motive in doing this. There are a number of involved problems to solve. You are the experts in the field of technical writing, and with your assistance I believe the results of the AFSSC actions will be more positive and meaningful. I hope you will be encouraged to lend us your full support.

Those of you not acquainted with the organization I represent, the Armed Forces Supply Support Center or AFSSC, may need a point of reference. AFSSC is a staff organization of the Secretary of Defense. The Center's principal responsibilities are to administer the defense standardization, to catalog, to coordinate material utilization programs within the Department of Defense, and to make studies to analyze the various aspects of supply operations within the services for the purpose of achieving greater efficiency. It is a result of the standardization responsibility that the technical manual study was assigned to AFSSC. However, the work is being closely coordinated with the Director for Supply Management, and with the Director of Maintenance Policy in the Office of the Secretary of Defense.

Mr. John Lawlor is the engineer in our division who is the program manager for the work.

At this point let us take a brief look at the background of the study. A considerable number of factors were involved. First, purchases of manuals represented a sizable portion of the procurement dollar; second, manuals were not always as effective as they might be; third, sometimes they were not ready when needed; and fourth, differences in military requirements and practices were leading to increased costs and production problems. As a result, the study was initiated last July with the following as its objectives:

1. Unification of military requirements. We knew of over 250 basic specifications being used in the services.

2. Reduction of costs.
3. Improvement in preparation and processing.
4. Assurance of timely availability, that is delivery of manuals when the hardware is delivered.
5. Unification of military quality control procedures.

In addition, it is planned to review new methods of presenting and communicating operational and maintenance data in the course of the study.

This is not an easy assignment. We realize considerable effort will have to be expended to achieve all of the objectives. Yet, we believe we are on the road to doing this. With the support of organizations such as yours, better progress toward these goals can be accomplished.

Our first problem was one of manpower as our division is quite small. The answer was in hiring additional help through the media of contracting. The firm is the American Machine and Foundry Company, Alexandria Division. Our method of attack on the problem is multipronged. We collected and reviewed the applicable specifications, standards, exhibits, guides, orders, directives, etc. A large number of military activities and industrial firms (40) were visited to secure at first-hand their views and recommendations. These visits included users such as Vandenberg Air Force Base, the Norfolk Naval Station, and Army Ordnance Mobile Maintenance Units. They also included top level military manual requirements people such as the army maintenance board. The third category of people consulted on these trips were contractors who produce manuals, including publications houses and vendors as well as weapon system contractors. Our people reviewed applicable literature, and comments were invited from your society and from industrial associations such as the National Security Industrial Association, the American Ordnance Association, the Aerospace Industries Association, and the Electronics Industries Association.

All of this information is being analyzed, and as segments of the work are completed the results are submitted for review by a military working group composed of representatives from the Army, the Navy, the Air Force, and the Marine Corps. In this manner we can secure a quick appraisal of the progress, and at the same time the working group provides guidance for the program, ensuring that we do not wander off on a nonproductive tangent.

Carrying the operation one step further, we have plans to set up a Military Industry Working Group that will take the preliminary results, give them a broad-based review, and recommend a firm program. This will be done under the direction of the Armed Forces Supply Support Center. Specific jobs outlined under the program will then be assigned to a military service which in turn will establish a working level industry group to give guidance and assistance in prėparing the finished specifications and standards.

So much for our procedure. What have we done to date? The Military Working Group and the majority of activities interviewed recommended that the first step be the development of a unified specification covering the general requirements of technical manuals. This specification might replace such existing documents as MIL–M–15071, Manual, Technical, for Mechanical and Electrical Equipment (Less Electronics); MIL–M–5474, Technical Manuals, General Requirements for Preparation of (supersedes AN–H–7); and requirements in the style guides used by the Army Technical Services. A draft of this specification has been prepared. We hope to submit this draft to the Military and an Industry Working Group in the near future.

Incorporated in this draft are a number of concepts that you may find of interest. Three types of manuals are provided: type A manuals are those with relatively stable content, type B manuals are those subject to considerable change, and type C manuals are those for equipments still in the research and development category. The reason for this division is fairly obvious. Twenty copies of a book can be all that are required for an item under development. After all, the item may never advance beyond this exploratory stage. The books will be read only by trained engineers and technicians who have a considerable background and knowledge of the equipment.

On the other hand, 10,000 copies of a book for a production item can be produced. The book will be used in schools for training new recruits, it will be used in the field by men with limited technical knowledge, and it will be used by trained mechanics in overhaul depots. It would be illogical to insist that a standard quality of book be prepared in both of these cases.

Yet an equipment can progress through the research and development stage, through the service test and field test stage, to full-scale production and general usage. Compatible sets of requirements covering manuals for these several stages are therefore desirable. Our people plan to dovetail the several sets of requirements so that as much as possible of the type C book can be used in the preparation for a type B book, and the type B book for the type A book.

Another concept being considered is that reproduced or printed copies of type B and type C manuals be secured directly from the producer. Small quantities are involved, and there is little or no financial benefit to the government to secure manuscript or reproducible copy in these instances. And most important, the time element is critical here. Securing reproduced copies means that the entire responsibility for production of a book on schedule is placed on one organization. They would have all phases of the work under their management. This should aid in ensuring that books are in the field when the technician requires them. Furthermore, it will eliminate the need for specifying details of techniques and procedure. Judgement can be made on the final end product.

In addition to specifications on general features, other specifications will be developed to cover the requirements peculiar to a technical field or an equipment area. Manuals for electronics equipments are one of the first to be examined, and aeronautical equipment manuals are a second area. The results of this work have not advanced to a stage where I can tell you of the conclusions. However, the two cases I have mentioned indicate the direction of the effort.

So much for specifications. They represent one phase of the problem. But the problem is much larger than just one of unifying or standardizing existing requirements. Essentially, a technical manual is a collection of detailed data required by an equipment operator or the maintenance technician working on the equipment. There is no doubt about the word "required." A technical manual is the one piece of documentation that the man in the field must have to do his job properly. But just what is the essence of his requirements? This is one of the answers that must come out of our study project. What he needs is adequate information that is accurate, complete, and arranged in such a way that it is readily understood. The use of language and illustrations he can comprehend, in other words, quality technical writing and illustrating; these are the essence of the book. But just how do we set down on paper these requirements so that everyone will read and have a similar understanding of them?

Which leads us to other fundamental questions. What is the best form and method of presenting information so that it is most meaningful to the technician users? How can uniform and sound judgement of the quality of a technical book be secured? These are basic questions that are not easily answered.

Well, back to our problem questions. The final answers to questions such as we have posed will require much thought and consideration. You, the professionals in the field, are the logical source of answers to many of the basic problems. We in AFSSC will continue to provide the channels such as the industry advisory groups, industry working groups, and our contractor (American Machine and Foundry's Alexandria Division), channels through which this professional knowledge can continually be brought to bear on the technical manuals area until we have optimum solutions to its problems.

THE MODULAR CONCEPT IN COMMUNICATION OF AUTOMOTIVE SERVICE INFORMATION

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Ford's complex information distribution requirements are being solved by the use of the modular concept of providing automotive service information. Service information must be made available to the various technical and skill levels of the users, such as the Service Technician, Dealer, Schools, and automobile owner. To accomplish this distribution, the modular concept is divided into information elements, modular communications units, and communications structures. An information element is the basic information structure concerning specific areas. A modular communications unit is composed of the information elements required to fulfill the user's particular requirement such as a shop manual, slides, etc. The communication structure is a group of modular units. In this manner, information groupings that will provide the required information for the skill level of the user can be obtained by selecting the applicable modular units to form a communication structure.

I am happy to be with you, and while I am not exactly in the role of Paul Revere according to the Texans, I am glad to be getting the benefit of your experience with instruction books. Texans, I am told, look down on Paul as that fellow who ran for help! Almost anything we can learn about publications is important because publishing is expensive — and our budget people can be more unhappy, more persistent, and win arguments more frequently than any other people I know! They can even have reason to be as they are because the Ford Division Service Department spent just under one million dollars on the 1961 model publications. These publications required 34,000 man hours to prepare 26,000 pages and 6,000 illustrations.

Now, what was the purpose of this considerable expense? We spent this million dollars to improve service on our products. This sounds simple in a nice, short sentence, but first let me give you some idea of the complexities involved, then I'll show how the modular concept is pointing the way to a better service information program. We have only started to implement this concept, but what we see thus far looks good.

One of the main sources of complexity is the ever-increasing product line itself, which includes 2 models of the Thunderbird, 8 of the Falcon, and 17 of the Ford. In the car line are 10 engines, 7 transmissions, and 14 rear axles. In addition to this relatively simple lineup, however, there are 619 models of trucks in 46 different series. These incorporate 12 different engines (including diesel), 34 different transmissions, and 146 different rear axles. The trucks range in carrying capacity from about three-quarters of a ton to 38 tons.

As we hope you know, your Ford dealer sells more than these cars and trucks. Among other things he sells repair and maintenance service, and to do this he needs a great many kinds of information for his employees and his customers. There are at least 14 categories of information that we must provide for our dealerships, and between many of these 14 categories there is a close relationship. For instance, in the case of a carburetor part replacement on a truck with Transmatic Drive, the Service Technician can need as many as six of these categories of information: he replaces the part (*repair*), he adjusts the carburetor and linkage (*maintenance*), he coordinates carburetor, engine, and transmission operation (*theory*), he uses *special tools* and *specifications*, and he can road-test the truck (*operation*). Similarly, when the Service Manager decides whether or not he should buy a piece of test equipment, he too must call into play several categories of information. The car or truck owner also needs various kinds of operation. and maintenance information.

Now turn from the complexity inherent in the various categories of information to that inevitable in some of the people and the dealerships who require information from us. Consider, as an illustration, a few differences in backgrounds of our 53,000 Service Technicians who are spread over the United States in about 6,800 dealerships. One can have been servicing and repairing vehicles for thirty years, or another can have just completed training in the Ford Student Technician Training Program. Still another man can be the only full-time technician in the dealership at Cut Bank, Montana. He has to be able to perform any kind of service work that is brought into his shop—and he is 750 miles from the assistance of the District Office in Fargo. Contrast this situation with the information requirements of the technician who is one of 35 specialists employed in a large metropolitan dealership located in the same city with the District Office.

In addition, we must consider the varied information requirements of the Service Manager and the Service Salesman in work environments that vary as widely as the technician. We must consider also the needs of the student who will become a Service Technician next year or the year after.

So we see that there is a complex body of information to communicate to large and variegated groups of people whose information requirements are widely diverse because of variations in experience, job responsibilities, work environment, etc.

Obviously, we must utilize every available channel of communication if we are to reach all these individuals with enough necessary information when it is needed. The simplest channel and the most commonly used is, of course, the printed word in the form of manuals, handbooks, or bulletins. Over the years, we have developed very efficient procedures for preparing and distributing these publications, which are, and I believe will continue to be, our fundamental communications medium.

I am sure, however, that I need not detail to you the shortcomings of exclusive reliance on printed media. You know of the difficulties inherent in trying to prepare manuals that will convey all things to all men under all conditions—and in trying to ensure that once prepared, they will be read and kept up to date. Consequently, we have all found it necessary to supplement printed communications with audio-visual aids. We have classified these as training and, in too many cases, have tended to consider training an entirely separate and distinct entity. The use of these media has made available several additional channels of communication under the general heading of schools.

The Ford Division operates two types of schools. The District Service School, of which we maintain 36, is a permanent facility with complete shop and training equipment, and is staffed by a permanent full-time instructor. Courses are conducted continuously for dealer personnel who come to the school for periods of 3 to 14 days. For people remote from the school, and for subjects that require less elaborate instructional equipment, we conduct "In-Dealership" schools. For these, an instructor travels to the dealership with the instructional materials and conducts classes on the premises. Usually, personnel from surrounding dealerships are drawn into these schools.

We also encourage dealerships to conduct "Intra-Dealership" training. As the name implies, this is training conducted in the dealership by the dealer's own personnel. Since we cannot expect highly trained and experienced instructors in this situation, we must provide a more self-sufficient type of instruction material and training aids. Ford Division is making a strong effort to provide an ever-increasing amount of such course material.

In addition to the above schools, the adult and vocational education programs of the public schools must be utilized to communicate some of the more basic or theoretical elements of technical and management information. To do this, we have found it advantageous to provide assistance to these schools in the form of lesson plans, course outlines, training aids, and printed materials, oriented to the methods of instruction that have been developed and found most effective.

Taken all together, this represents a highly complex problem in communications. I have gone on at such great length about the complexities of the problem and the number of factors involved to make two points. First, that in spite of its complexity, this is still one single problem in communications, that is, we must convey to all interested people the information necessary to service our vehicles so that the customer can realize the full degree of satisfaction engineered into them. My second point is that, in such a complex communications problem, we must concentrate on careful, long-range planning to avoid repetition and duplication that can increase the cost of preparation without commensurate improvement in the information.

We of the Ford Division are finding that a point of view toward communication of information, which we refer to as the modular concept, is showing the way to better communications. This concept considers information as flexible blocks that can be combined in different patterns according to the specific communication needs determined by the definite circumstances of a particular time and place. It is comparable to the principle used in the kitchen of a high class restaurant which offers a variety of appetizers, salads, entrees, and desserts, from which the head waiter can select and combine to make up a menu that will fit the nourishment needs and appetite of each individual customer.

In our work with the modular concept, three basic terms are used: *information element*, *modular communications unit*, and *communications structure*. An *information element* is simply the product of breaking down into workable size pieces the total body of information to be conveyed. For instance, the information on vehicles is broken down into body, chassis, electrical, and engine classifications. These in turn are further analyzed so that, for instance, chassis information can be subdivided into suspension, steering, frame, transmission, driveline, axle, wheels, brakes, etc. Information about each of these components is further broken down into theory, maintenance and diagnosis information, repair, operation, etc. By careful consideration of each one of these information elements, to determine the ways in which it will be used and the people who will use it, these elements are combined to form *modular communications units*.

A modular unit can take many forms. It can be a shop manual section, a sound slide film, a flip chart, or a set of instructor's notes. In some cases it can even be a complete course outline for a full semester's course of training for a Student Technician. Though modular units can be dissimiliar in form, they all have two common characteristics: each unit is complete in relationship to some aspect of a Ford automotive function, and each can be used with one or more other units with no duplication of information.

Our objective, of course, is to plan production of these modular units so that *anyone* needing to communicate either a specific item or a general type of service information can draw upon a bank of these modular units. This bank offers all the necessary kinds of information in a form adaptable to combination into a structure most effective in any circumstances, prevailing at that time and in that place. The group of modular units slected and put together to do this communications job is referred to as a *communications structure*. The *communications structure* can consist of one or many modular units. For example, the trained and experienced technician might need only the specifications booklet to adjust the steering gear; but a Student Technician might need, in addition to the specifications, information on theory, diagnosis, disassembly, and reassembly.

With our terminology at least tentatively clear, let's move on to a couple of illustrations to show the adaptability of information formulated under the modular concept. Suppose that your wife complains about a scraping noise that occurs in the car when the engine is running and the clutch pedal is depressed. Now, of course, if your wife is like mine she will probably fix it with a hair pin and confound all our carefully thought out theories about information and its communication. However, most of us would take the car to a dealership where the Service Manager or the Service Salesman would tentatively diagnose the trouble as a defective release bearing and assign the car to a technician for repair. The Service Salesman has had available to him through modular units the specific information he requires about theory, construction, and diagnosis of problems which enabled him quickly and accurately to pinpoint the problem and determine its solution. Incidentally, if we have done a good job of communication, the Service Manager should mention to the customer that riding the clutch pedal can be hard on a release bearing.

Now what kinds of information are necessary for replacement of this bearing? Remember that we are talking about information in the abstract rather than in tangible form. To do the job the technician must have knowledge of transmission and clutch theory, maintenance, assembly and disassembly, specifications, and special tools. If he is well trained and experienced, he probably absorbed most of this information previously, therefore, on a specific job he will need to refer only to the specifications to assure himself of the proper part to be used for that installation and the proper adjustments to make on it. The less experienced man may need to consult assembly and disassembly instructions. If he is a real tyro, he may have to go back and review some of the theory and construction information about the clutch and transmission to enable him to understand the repair instructions. When this information is made available in modular units, we simplify the technician's job in locating the exact information he needs under the specific conditions which exist at the time. It is not necessary for him to search through a bulky compendium to sort out the specific item of information needed at the time. As a second illustration, consider the problem of the Service Instructor who is responsible for the training of both the technician and the Service Salesman. Let's assume that he must provide the necessary information on a new engine for dealer personnel. Through close association, this instructor knows much better than we at the general office the requirements and capabilities of the people to whom he must transmit this information. Therefore, we provide him with different types of relevant modular units and let him use what he feels he needs. A communications structure for this type of a situation might consist of several modular units such as a slide film, a flip chart, a set of instructor's notes, a section of the shop manual, and a specifications book.

As we pointed out earlier, our job involves the transmission of a great deal of service management type information as well as technical information. While most management information is oriented to the dealer, his Service Manager, and his Service Salesman, a considerable amount of it must be communicated to other Service Department personnel, such as the Service Technicians, parts men, etc. By careful planning, we can organize this material into modular units, which will greatly ease the job of the local instructor in transmitting the right type of information to the proper people. We can also encourage absorption and retention of this material by concentrating the modular unit on just the information that the audience needs and desires, and not cluttering it with additional information that is aimed at a different audience entirely.

In discussion of communications with dealer personnel we must not forget that we must also communicate with the owner and operator of the vehicle. There is a substantial amount of infomation that he needs to operate the vehicle properly in order to get the highest degree of satisfaction from it. We reach the owner or operator through driver training schools, through advertisements, through printed material placed in the glove box of the vehicle, through decals affixed at appropriate places on the vehicle itself, and through personal contact between the operator and dealership personnel. In our planning we must include modular units designed not only to communicate directly with the operator, but also indirectly to him through dealership personnel. In communicating with owners, as with dealer personnel, we must plan very carefully to ensure that we have available the necessary modular units to communicate with the specific operator who is involved. Careful planning can also result in substantial savings if the modular units created for owners and operators can be used with dealership personnel and students.

At this point, one needs little imagination to see the advantages of the modular concept. As we implement this principle, the quality of our information improves, mainly because we are strongly emphasizing user point-of-view. As a result, we are eliminating unnecessary and duplicated information for any given user, while we make available more of what he wants and needs in improved form. Far better to accommodate a technician with a specifications booklet if he needs only specifications than to alienate him with an 850-page book in which he must hunt for what he needs. As a matter of fact, he might *not* hunt, and service quality could suffer. Perhaps the most obvious benefit is flexibility through application of the modular units. As you have seen, the same information is frequently applicable in more than one situation. Furthermore, the way of yesterday is not the way of today. As tomorrow's information requirements change, it will be less difficult and less expensive to alter the appropriate modular units than it would be to change larger and more comprehensive publications. The benefit which is most appealing to our controller is, of course, reduction in cost. By cutting down on duplication of information we reduce requirements for preparation time, typesetting, artwork, printing, and paper; and, as we pointed out earlier, the constant process of updating is also less expensive.

Two or three times I have suggested that we are in the process of extending the modular concept in our information program. As we look ahead, we anticipate gradual elimination of our shop manuals in favor of series of modular units to be called Quality Service Handbooks. Each of these will cover one subject for the entire vehicle line. Thus, a carburetor specialist will find his type of information in one source and the technician who needs information on rear axles will find his in another. Whether or not a technician is a specialist, he will find information much more readily than in a thick shop manual. For these handbooks we have developed a more flexible format that will allow economical updating. We shall, thereby, eliminate much of the costly reprinting now necessary with our shop manuals. Another significant merit of this proposal is that revision of the handbook will signal our dealer personnel that there is available new information to which they should give their attention. Thus for anyone who needs or uses Ford automotive service information, the handbooks will provide current, comprehensive, and detailed information available in a readily usable form to meet his specific needs.

We foresee that through the application of the modular concept, we will be able to increase by about 30% the assets of our information bank at no increase in cost. We believe at the same time that we will effect great increase in the amount of this information that is absorbed and put to use by the people who need it.

We feel that the modular concept is working for us now, and that it will continue to show the way to improved service for you in your Ford dealership.

USE OF AUTOMATIC MACHINE DATA IN TECHNICAL MANUALS

by Robert D. Johnson
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With the increased complexity of equipment and the requirements for rapid dissemination of information concerning the equipment, the use of automation to prepare portions of a manual should be investigated. Mr. Johnson discusses automation with regard to the preparation of wiring information, the savings in time and money, and the adaptability of an automation program for use on similar systems. Information updating of drawings is greatly facilitated, as is the ability to obtain complete sets of drawings in a few hours.

In this era of rapid advance in both the basic and applied sciences, no one need remind a group of publications engineers that effective, rapid, and accurate communication is essential.

The conventional methods of producing technical publications, which formerly kept pace with research and development, are today almost totally inadequate. This situation has induced a demand that technical information be more efficiently produced, and more speedily disseminated. Those of you in the engineering and writing professions are faced with the challenge of developing improved techniques, methods, and systems for recording and disseminating technical information.

My purpose here is to describe what I think are some of the new developments which can be exploited in preparation of maintenance data for technical manuals. It is my hope that the discussion, while perhaps not solving each individual's immediate problems, will stimulate our thinking in the area of technical communications, and make us recognize the need to seek new developments.

Designing a technical manual for today's equipment using yesterday's techniques could be disastrous from the standpoint of cost and delivery. Limited quantities of complex electronic systems are procured, meaning we no longer have the advantage of long production runs to firm up technical data. Each set of technical manuals must be treated as a research and devolpment project requiring special analysis to develop the best methods of providing adequate maintenance data for a specific program. Methods used on one program cannot necessarily be applied directly to the next program.

Advances in engineering have brought forth new methods of equipment design. One of the most prominent methods is that of logical design. Logical design uses standard building blocks logically interconnected to perform required equipment functions. I believe that most of us are aware today that the "State of the Art" in logic design has advanced to the point where computers are being used to design new equipment. If actual equipment design is being accomplished with computers, why not extend this application to development of data for the technical manuals?

Automation in technical manuals may sound as if it is an inappropriate subject for professional writers and editors. However, let us remember that a major part of a technical manual is maintenance and reference information designed specifically to aid in the proper operational support of equipment. The Technical Writer will not be replaced by automation; however, he must learn to use it effectively freeing himself to devote more time to the creative aspects of his work.

Automation is being used today in the preparation of technical manuals. Two significant areas that come to mind are parts listing and wiring information. I am not going to touch on parts listing since I believe it is a separate subject.

Wiring diagrams for years were produced pictorially. As the equipment being designed and constructed became more and more complex, the wiring diagrams necessarily became more complex. Many of you can remember trying to use a wiring diagram that was twenty feet long. The information on wiring diagrams was then converted to point-to-point interconnection lists. These lists are now being produced by automatic machines and provide the same information more accurately and economically. The logical design techniques of today are putting us to the test once more. Five years ago, a radar set that had 1000 vacuum tubes was considered a complex piece of equipment. Today, equipment that physically occupies many times less space contains hundreds of thousands of transistors and diodes. It is obvious that we are faced with the same problem as confronted us when the wiring information became an insurmountable problem using outmoded methods. Extension of the same techniques used to streamline the wiring diagram problem can be applied to other types of information, such as functional diagrams and logic schematics.

The method used to date to develop technical data on complex, logically designed equipment is to develop what is commonly known as a logic diagram.

The logic diagram that you see here was developed by hand from logic equations supplied by the design engineers (Figure 1). This diagram represents only a small portion of an equipment and only part of the drawing. The translation of the design information into complicated diagrams is a long, tedious, and costly process. Furthermore, the value of this type of diagram is questionable. It does not contain enough information to permit effective maintenance on the equipment. As new methods of implementing logic design were developed, it became obvious that the hand-generated, logic-diagram method was neither technically nor economically sound.

Faced with these problems we investigated thoroughly the techniques being used for automated equipment design methods. The results, needless to say, were at first quite astounding. We discovered that punched cards containing all important data on each building block of the system were available. Naturally, if the required information could be extracted from punched cards and collated into an acceptable format, many of our problems could be solved. Working and planning with the design engineers and programmers, we discovered that present automatic data-processing equipment can actually draw the detailed logic diagrams that are a vital portion of the technical manual. The programming effort required to produce the diagrams was much less than the cost of manually preparing the same information. Furthermore, once such a program has been written for a particular system, it can be easily modified to adapt it to the requirements of other similar systems.

Figure 2 is an example of such a machine-produced diagram. This diagram is the complete re-

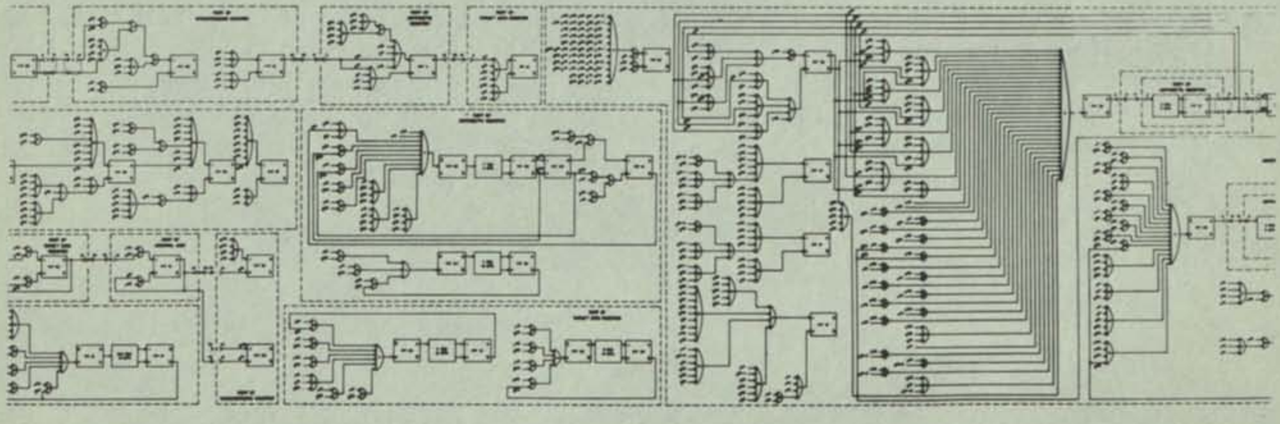

Figure 1—Hand-Drawn Logic Diagram

presentation of one functional element with its associated inputs and outputs. The diagram may be used "as is," or a number of these diagrams may be pieced together to represent a functional operation. To represent the same equipment as illustrated previously on the hand-drawn diagram, we merely have the machine print multiple sheets.

It should be noted also that this drawing contains all information required for maintenance of the equipment.

Once the program is established to print out diagrams of this type, much of the other related data useful in the technical manual can also be generated from the same set of punched cards. This data can include logic equations, input-output lists of each major unit, and double-entered wire lists and others as applicable.

I believe we can readily see the advantages of employing these techniques. The first and most important is the assurance of the accuracy of all the data because it is developed from a single source. We have just eliminated the many steps that produce human errors in the normal development of complex diagrams. Second is cost reduction: on a recent large program, machine diagrams were prepared for an estimated 1/5 of the cost of the hand-drawn diagrams. The final advantage, and possibly the most important, is the speed and ease of updating the information to the latest equipment configuration. After the initial program is established, a complete set of drawings on a complex system can be produced in a matter of hours. Revision sheets can be produced in an even shorter period of time.

The one stumbling block is that people react unfavorably to long-established custom. Nevertheless, we have succeeded in substituting wire lists for wiring diagrams, the standby of the services for years. Engineering and manufacturing departments now realize they can do without detailed circuit schematics, but our problem is to convince the services that the old-time schematics are a luxury they can do without. In order to do this, of course, we must provide a satisfactory substitute.

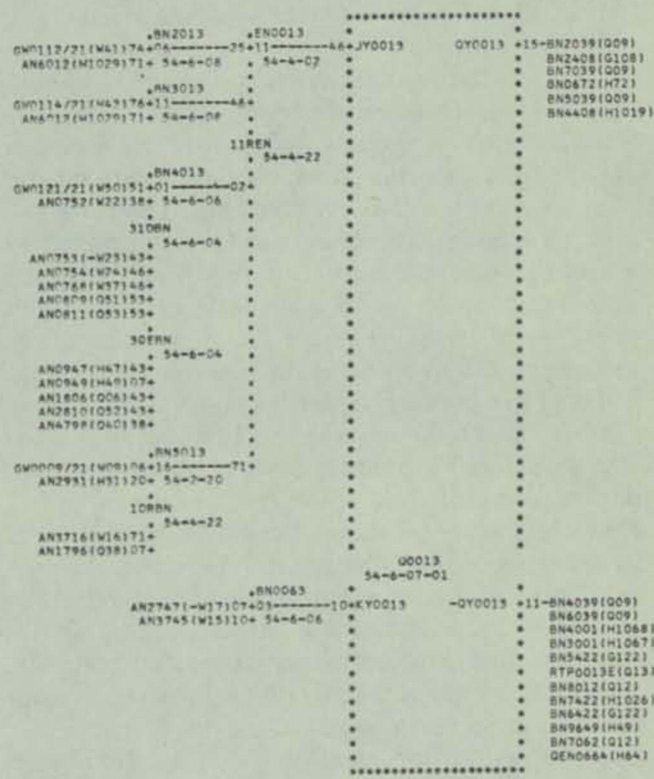

Figure 2—Machine-Drawn Logic Diagram

The over-all program described may sound as if it is a radical departure from present techniques, but many of the intermediate steps, such as various methods of automatic drafting, have already been undertaken by leading companies. Parts of the future picture are already here, and *all* that is proposed is the imagination and talents of people such as you to bring about the marriage of new but *existing* techniques.

PANEL 2 — NEW APPROACHES IN EDUCATION AND TRAINING

GRADUATE TRAINING AND RESEARCH IN TECHNICAL COMMUNICATION

by Clifford F. Weigle
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Graduate training and research in the new field of technical communications is described as an area that may provide a common language for approaching the problem of technical writing. A program is suggested that would consist of communication theory, supporting courses from the social and behavioral sciences, and instruction in writing and editing. Typical areas of study are discussed briefly.

Technical writing and editing is a new professional field that has grown with fantastic rapidity. It is my impression that personnel has gravitated into the field from, broadly speaking, two educational and experience backgrounds: Some persons with engineering and/or science as major interest; and even more people interested in writing, with principal preparation being either in literature and creative writing, or in journalistic writing with a supporting education in social sciences and humanities. (Of course, these are only presumptions. We should have available the results of definitive personnel studies showing where the most successful professionals come from.)

When you take a staff ranging in educational preparation from engineers through psychology and history majors to English and philosophy majors and stir in a few artists, photographers, and other technicians, you have a motley group to coordinate in an operation that should be as smooth as a sip of French onion soup from the world's finest chef. It is my contention that the cookbook approach may work in making French onion soup, but it is not the way to handle a task as complex as yours where you should be drawing upon all the resources of the behavioral sciences as well as the writing arts. Your people should speak a common language when they discuss what they are trying to do, how they are going to do it, and what problems must be solved in order to achieve maximum effectiveness. I believe that mass communicaton theory offers this necessary common core of understanding.

A word about communication theory might be in order for those of you who have not encountered it recently. In the same way that your field of technical writing and editing blossomed in the pressures of World War II, so did the study of communications as a theoretically-based process expand, mostly in connection with content analysis related to propaganda work and the massive contributions by Hovland's group on attitude and opinion change. From the propaganda studies we have the early and best-known statement of the communication process in the form of Lasswell's five questions:

"Who?
"Says what?
"Through what channel?
"To whom?
"With what effect?"

Then, after the War, came the landmark publications by Shannon and Weaver in information theory; and from this highly sophisticated work communication scholars borrowed much-needed terminology, so that Lasswell's description evolved as five steps involving:

Encoders
Message
Channel
Decoders
Effect

There are names for related factors which include: Mass encoding, redundancy, channel noise, gatekeepers, feedback, fields of experience, etc.

Thus, we see developing this field of communication theory and research as a result of work by certain scholars from political science, sociology, psychology, English, journalism, and possibly others. Problems are studied both in the laboratory and in the field. The methodology is primarily behavioral, utilizing the statistical procedures, but, at the same time, needing for some problems the aesthetic insight of persons schooled in literature and creative writing.

The place has now been reached where a major need is for the codification and utilization of more of the key research findings. Dr. Wilbur Schramm director of the Institute for Communication Research at Stanford University, states the need in these words:

> ". . . Some effort is being made to solve the problem of how to describe and catalog the necessary decisions and chief problems in this area of social science. It is clear that if this could be done systematically — as, for example, the diseases of the human body are cataloged and described in the field of internal medicine — then it would be immensely easier to design useful research, *to train practitioners*, and to assess current knowledge."

Now, how should we train practitioners at the graduate level? (To produce *communicators* rather than semi-skilled or skilled craftsmen.)

I would assume that for the most part young people entering your field have had an undergraduate education stressing engineering, or science, or social sciences, or humanities — that is, no necessarily common pattern except that they liked science or writing or both. We would superimpose a graduate curriculum ranging in length from one year to an M.A. degree to three years or more to the Ph.D. degree. The program for each student would be tailored to his individual needs in relation to his background, his professional experience (if any), and his professional goal. It would be hoped that every student would get as a minimum:

a) Some understanding of communication theory and its application in practice and in research.

(The basic purpose of my remarks is to show the logic of the study of communication theory if *technical communication* is to be a science, as well as partly an art, and not merely a trade or a craft. The old and experienced hands can operate by rule-of-thumb and get the job done acceptably. But how can they transmit an understanding to others, and how can they systematically discover better ways to hit their targets?)

b) Certain supporting courses from such fields as learning and perception, social psychology, motivation and personality, small group behavior, methodology of the behavioral sciences, and statistics.

(The supporting courses in behavioral sciences supply insight and methodology developed over many years by these fields of behavioral science — and, for our purposes, *focused* on communication problems.)

c) And, finally, adequate professional level instruction in writing and editing skills. If this part of the program can be achieved at least partly by some sort of internship work in the field, so much the better.

(The skills are in some ways the least vital part of the *educational* process. Students must, of course, be *weeded out* to get rid of the nonwriters, or to see that their ability to use English is brought up to a certain standard. In addition, you probably would prefer beginners to have knowledge of certain basic skills to expedite the training process.)

There are very few places, as yet, which offer this type of training approach specifically aimed at technical writing. An increasing number of our better universities are, of course, actively using the "communication approach" in journalism and other forms of specialized writing. But the still-dominant teaching method for technical writing is indicated by an examination of the textbooks labeled "technical writing and editing," or "scientific writing." They are either how-to-do-it books or rewritten English composition texts.

The final question I want to take up briefly is, "Where does research enter the picture?"

If you are operating purely as craftsmen you do things by rule-of-thumb without worrying much about why you are doing them that way, or whether your procedures are as effective as they might be. But I'm sure that most of you at times encounter problems that worry you, procedural dilemmas where you'd really like some guideposts, or at least some reassurance. In this area there is an almost wide open opportunity for research, some basic, but also much directly applicable to everyday problems. Here are a few current examples picked at random:

At Stanford: Blankenburg and Brinton are planning to extend a study made last year of aesthetic values of type faces. They found that semantic differentials would give a clear profile of aesthetic qualities of type faces *as those qualities are perceived by readers.* (Among the findings: The professionals and the readers don't always agree. The authors' final word: "We should be able to establish at some future time that the art of typography has a very central position in the science of communication.")

At the University of Michigan: Among studies presently under way are ones specifically dealing with the communication of scientific information and in analysis of written messages. Some examples:

Semantic images of scientific concepts, with special attention to differences of such images between groups of subjects with varying degrees of science background.

Content and stylistic analysis of science writing, using materials of different levels of scientific sophistication.

Decoding of scientific writing.

Science-ese: The language of public science communication.

Dimensions of judgments of scientific writing to determine the similarities and differences between scientists, science writers, editors, and readers.

The effect of feedback.

And here are some examples of Michigan studies involving analysis of written messages: (Work in message analysis is being done also at Illinois, Harvard, and Indiana.)

Factor analysis of written structure: A new readibility formula. (An interesting finding — two simple message variables, when combined, yielded a reading-ease measure highly similar to the much-used Flesch score. The variables: (a) Ratio of final punctuation marks to total words, and (b) a character density ratio (roughly a ratio of black to white space on a page).

Relation of stylistic factors to comprehension and reading time.

Effect of punctuation: Effect of different degrees of punctuation on denotative and connotative meanings derived from a passage. Consistent patterns of differences were found.

And, in the area of "aesthetic communication," Tannenbaum has a book manuscript nearly completed on the meaning of colors and the effects of colors in the judgment of other objects. Other "aesthetic" studies include one in the effects of lighting angle in photography, and in dimensions of news photography judgment (similarities and differences between photographers, editors, and readers).

I hope that these illustrations are enough to suggest that communication research can be research that offers specific help in problems facing you today.

To summarize what I have said, I propose that the principles of communication theory developed in the past 15 years offer the best means we have of establishing a common meeting ground, at an advanced level, for producing competent technical writers and editors and supervisors from persons having backgrounds as diverse as engineering and literature and creative writing. The graduate curriculum should include study in communication theory, behavioral sciences, and communication techniques. Furthermore, communication research — theory oriented and using the methodology of science — offers a way to find answers to problems that we have attacked in the past most often by blind trial and error.

I would hope that the time is not far off when each of you will seek answers to your problems of communication, through every step in the process, by research in the laboratory and in the field just as routinely as your departments of research and development now proceed to solve their engineering problems. I submit that it is an exciting prospect. The proper role of the professional school will be, in the words of Wilbur Schramm, to help train practioners and to serve as middleman between the professionals on the job and the basic scientists — to interpret needs of the professionals to the scientists and the findings of the scientists to the professionals.

IN-PLANT TRAINING IN TECHNICAL COMMUNICATIONS

by John A. Walter
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Austin, Texas

The results of a survey of in-plant training programs in written communications are presented in detail; this survey covered over 300 companies, the majority of which felt that such programs were useful. A typical in-plant program, in which the author participated, is described at length.

INTRODUCTION

In the time at my disposal, I shall try to do two things. The first is to report to you some results of a survey which produced some facts about in-plant training in communications. The second is to tell you something of my own experience with in-plant training. After some description of five types of training activity embracing short, intensive courses in effective communication, seminars on special communication problems, specially prepared instruction documents, individual counseling, and continuing training as a by-product of publication department editing, I shall attempt a brief evaluation of the worth of these activities.

SURVEY OF IN-PLANT TRAINING

First for the survey. Answers to a questionnaire sent a little more than a year ago to some 300 industrial organizations reveal that roughly 45 per cent of them conduct in-plant training in written communication. (A followup survey made of a smaller sampling—30 companies—which was made last summer revealed that 75 per cent of them offer such training.) Of the companies making this training available to their staff, some 78 per cent state that it has been beneficial; the remaining 22 per cent state that they do not know whether it has helped or not. Of those companies not offering the training, some 74 per cent stated that they believed such training would be helpful; 25 per cent said they did not know; and one company said "No," it did not think such training would be of benefit.

The questionnaire also asked for information about who conducted the training: a member of the publications staff, someone from the technical staff, a professional educator or communications consultant, a member of the administrative staff, someone from the public relations department, or some other specially selected person. The results are as follows:

Publications staff	40%
Technical staff	24
Professional educator/ consultant	25
Administration	20
Public relations	9
Miscellaneous	17

It is obvious from this listing that some companies make use of more than one type of instructor.

The limited follow-up showed about the same division: 25 per cent were from publications, 25 per cent were professional educators or consultants, 19 percent were from technical staff, 6 per cent from administration, and 25 per cent miscellaneous.

This questionnaire shed some light on the reasons for offering such training. Respondents were asked to check a list of common writing faults or weaknesses to indicate which of them had proved to be serious problems in the writing of their personnel. The replies show that the most common faults are these (the percentages refer to the number of companies checking each fault):

Lack of clarity	91%
Poor organization	81
Wordiness	75
Ill-adapted style	54
Poor word choice	43
Punctuation errors	33
Grammatical errors	29
Spelling errors	28

I think it is interesting to note, in passing, that this list supports the view that schools are doing a fair job with their training in the fundamentals of spelling, grammar, and punctuation. Unfortunately, it does not speak so well for the training in the really important areas of organization and style, and I might add that a survey conducted recently by Esso Research and Development revealed that their recent graduates were weakest in communications skill (both written and oral) and in judgment.

Aside from in-plant training courses, many companies try to provide a partial remedy for poor writing through the use of writing guides. Some 48 per cent of the respondents reported that they issued such guides, with their coverage as follows:

General	64%
Reports	57
Standards	5
Manuals	12
Proposals	20
Letter-writing	30
Memoranda	13

DESCRIPTION OF IN-PLANT TRAINING ACTIVITIES

So much for the survey data. Now I should like to say something of my direct participation in some in-plant training activities. I shall confine my account to the work I have done with a single company during the last three summers (though the experience has been roughly paralleled by my work with the Military Physics Research Laboratory where I serve as technical editor). The company is Texas Instruments Inc., and the division I have worked with is called the Apparatus Division.

This in-plant training program had its beginning in the recognition of some of the company's principal officers that there was room for considerable improvement in the writing of the technical staff, chiefly the project-level engineers and those working under their immediate supervision — in short, those who do the bulk of the letter, report, and proposal writing. In a conference with the operations manager, the head of the research and development department, the head of the engineering services department, and the head of the technical publications department, we agreed in broad outline on a summer program to consist of two phases: (1) research and planning, and (2) a series of conferences or seminars dealing with effective writing principles.

The first of these phases was devoted to intensive study and analysis of a large number of representative examples of the types of writing done by the technical staff. Examples of some 27 types of documents were furnished for my study. Some of this period was devoted to informal conferences with department heads, supervisors, project engineers, and publications personnel — conferences in which I tried to pin down the writing difficulties as these men saw them.

Information gained from this study formed the basis of a series of effective writing conferences in which the problems encountered most frequently were dealt with. Besides some instructional materials issued to participants in the conferences, both excerpts from the documents examined and a selected few entire documents were used for illustration and discussion. As a matter of fact, most of the writing examined was written by the men who attended the conferences.

The groups themselves were limited to ten men each, with each group meeting one hour daily for 10 days, during regular working hours, of course. Department heads made up the rosters for the groups, usually from a list of those who had indicated a desire to attend.

About half of the sessions were devoted to problems of organization, style, and usage; the remainder to analysis and criticism of some selected types of technical presentations (memoranda, letters, trip reports, proposals, formal and informal engineering reports, etc.). Offset printed study materials were prepared for each session, with each participant receiving a handsome looseleaf folder for these materials. Each participant was also given a copy of a booklet I wrote on *Usage and Misusage in Technical Writing*, a glossary intended as a desk reference. During the sessions, extensive use was made of visual aids.

A second type of experimental program has dealt with proposal writing. This program was set up on a somewhat different basis from that used for the effective writing conferences. In our planning we decided that four inputs were needed: from management, marketing, research and development, and publications. In carrying out the program, a series of five 2-hour plus sessions, we arranged for the operations manager of the division to handle the first session devoted to management's view of the role of proposals in company success; the head of the force of field representatives dealt with the proposal as a sales tool in the first half of the second session; the head of research and development dealt with the subject of the proposal as a technical communication during the latter half of the second session; and I handled the last three sessions, which were devoted to problems of effective presentation. I gave each group a report of the results of my own analysis of a selected group of representative proposals, and the rest of our time was occupied in examination and discussion of excerpted reproductions of some key parts of some of these proposals, along with examination and discussion of a couple of complete proposals.

Personnel in each of these groups (again limited to about 10 men) were carefully selected to represent the field representative staff, technical departments, and the publications department (including not only editors but also illustrators). The reason for this "mix" is obvious. We wanted a free and full exchange of opinion among those who regularly worked together on these documents. We encouraged frank expression about means of improving cooperation with the proposal writer among those who are charged with offering him help: field service engineering, technical advisors from research and development, technical illustrators, technical editors — anyone, indeed, who might have some insight into the problem of proposal tactics. Some of the discussions, incidentally, became quite heated, but it was the heat that generated some light.

A third type of experimental program dealt with the reports sent in to the home office by the field representatives of the company — the service engineers or salesmen. These documents report the results of calls made by these men (hence dubbed "Call Reports"). The procedure here was for me to examine a large number of these reports and then to talk to those people at the home office who were on the distribution list for them. Then on the occasion that these field representatives were all at the home office for a series of conferences, we scheduled a short session, one afternoon, between them and me. In a highly informal atmosphere, we discussed the problems involved in writing genuinely useful reports of the almost daily calls made by these men. Discussions touched only briefly on the conventional topics treated in the effective writing conferences (except for the need to avoid jargon) and concentrated more on an attempt to devise a form and procedure for these brief documents that would ensure that they contain all the information needed by the home office staff. I should add that in these open discussions, I learned a lot about how hard it is to produce a good, clear report after a full day of conferences followed by a full evening of proefssional entertainment.

Finally, we arranged for some groups to consist entirely of publications personnel. Here we talked freely and frankly about ways and means of improving publications, together with ways and means of serving in an educational capacity. One way of allowing an editor a better opportunity of "training" technical staff writers has been tried. It is an arrangement for a particular editor to work with the same small group of writers on a semipermanent basis. I suppose we could say that the drill principle is involved in this plan. Another problem dealt with by these publications groups was that of bringing the editor and illustrator into a writing project at the very beginning, during the planning stage, rather than at the very end when a deadline is staring him in the face. My chief contribution to these sessions was, I daresay, a result of the greater breadth — if not depth — of experience I had had with technical writing problems and practices in other companies, together with the advantage of having devoted my professional life to a study of the craft of technical communication techniques. Formally prepared training materials were not used in these sessions.

Concurrently with all of these conferences and seminars was an informal counseling program or service. Its operation was simple. At the beginning of the seminars, notices were sent out to appropriate personnel announcing the details of these programs and stating that I would be available all of each morning for individual conferences. These conferences were entirely voluntary. They usually took one or both of two forms. Some individuals came to me for advice on a specific writing project that was in progress. Some came by to talk and to leave a packet of their writing with me for diagnosis and prescription. The documents I worked on ranged from fairly simple letters to fairly complex specifications and special brochures.

A less personal type of counseling involved my being asked to examine and criticize some special types of company publications, such as the quarterly technical report on the status of contract work and company-sponsored projects which is sent to top management. Other types included technical memoranda published in booklet form and dealing with special topics with the company's field of interest, special brochures, in-house safety bulletins, procedures manuals, etc. Suggestions for improvement of these documents were submitted to the appropriate company official by memorandum.

SPECIALLY PREPARED INSTRUCTION MATERIALS

From time to time during my association with the company, I have written instructional materials for distribution to technical staff members. These documents have included the following:

(1) *Style, Form, and Usage:* A 30-page booklet dealing with means of achieving a desirable technical writing style, ways of devising an effective organization for reports, proposals, etc., and particularly troublesome problems of usage.

(2) *A Glossary of Usage and Misusage in Technical Writing:* A 40-page booklet, in dictionary form, in which approximately 500 troublesome words and phrases are discussed. Broadly speaking, they include words frequently confused, misused, overused, redundancies, vague and indefinite words and phrases, glaring examples of technical jargon, etc.

(3) *Letters and Memoranda:* A 4-page leaflet on the chief weaknesses observed in company leton the chief weakness observed in company letters and memoranda, along with suggestions for eliminating them.

(4) *Two Weak Points in Technical Writing: Introductions and Transitions:* A brief discussion of these two critical problems in technical presentations.

(5) *Some Notes on Writing Proposals:* A 16-page brochure suggesting ways of increasing the effectiveness of technical proposals written for those already experienced in writing this type of document.

(6) Miscellaneous instruction materials: These included a large number of pages of "before and after" illustrations. Alongside an excerpt from a company publication I would present my revision in an effort to demonstrate how the difficulty could be solved. For some of these materials I used not excerpts but entire documents — chiefly memoranda, process specifications, trip reports, and the like.

EVALUATION

What can be said in evaluation of the work just described? I know that I do not need to tell an audience like this that it is difficult perhaps impossible, to measure the results of a training program in writing which is of short duration and for which there is no effective means of follow-up observation. In a general way, I suppose it can be said that the programs have been well received since I have been invited to come back for the fourth summer. I can speak with greater confidence about the results of my 10-year association as an editor with the technical staff of the Military Physics Research Laboratory. The writing of those individuals who have remained with the Laboratory for several years shows a marked improvement.

We did ask the participants in the effective writing conferences at Texas Instruments to evaluate the program. More than 75 per cent of them stated that they had found the sessions very helpful; the rest said they had been moderately helpful. No one reported that they had been only slightly helpful or not helpful at all. These men were also overwhelmingly in favor of follow-up sessions in which more extensive practice in writing under supervision would be done. In fact, only two men of more than a hundred were opposed to such training. As for the specific content of the training they received, these men were most enthusiastic about the study of selected excerpts from company documents and the study of complete documents. Finally, nearly all of them felt that ten 1-hour sessions did not allow enough time for maximum benefits. Many expressed the opinion that a refresher course should be made available annually.

Finally, if my own purely subjective evaluation is worth anything, such in-plant training is eminently worth while. I know one person has profited greatly from it: I have learned a tremendous amount about technical communications problems by working with an industrial organization, and like to think that my teaching at the university has improved as a consequence.

TEACHING MACHINES AND PROGRAMMED LEARNING

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This paper defines and describes the teaching machine approach to learning, and discusses the three primary techniques of programmed learning. The characteristics of automated programs are summarized, and some possible applications to the teaching of writing are mentioned.

THE TEACHING-MACHINE MOVEMENT

During the past three or four years it has been possible to pick up a newspaper almost any day and to read some account of a movement called "teaching machines." Since I am not aware of just how familiar this new field of teaching machines may be to the various members of the audience, I would like to first indicate some of the other names or phrases which may be encountered in the newspapers to identify this movement, and then to sketch briefly the history and present status of the teaching-machine art. Following that, I would like to attempt a few remarks more directly apropos to the subject of this symposium, and to indicate, at least in part, how automation might play a part in the training of technical writers.

In the newspaper and magazine accounts of teaching-machine developments one may encounter several terms referring to the same movement. One article may refer to self-instructional devices, another to instructorless training, another to programmed learning, and still another to automated instruction. All these terms are currently in use. The term "teaching machine" is in part a misnomer, inasmuch as the written materials prepared are often presented in special book or workbook form rather than by a machine. The term "programming" refers to the preparation of the educational material and its presentation to the student, and the particular format of the presentation may be known as a scrambled textbook or a programmed textbook or, on the other hand, the material may be presented by devices having various mechanical and electrical forms.

In the context of the present symposium our paper has been introduced as learning at home in contrast to learning in the school and learning on the job. It is quite correct that the teaching-machine movement appears to represent an unusually effective method for home study or instructorless training. Thus, correspondence courses could be conducted whereby the student would employ the programmed material at home as the sole means of instruction. However, it is important to recognize that teaching machines probably will be most widely employed in industrial and military training situations and in the public school classrooms. Thus, teaching machines may be employed as the sole method of learning at home, but they will perhaps be more widely employed as an educational aid.

THE PROCESS OF PROGRAMMING THE MATERIAL

The term programming here perhaps has grown out of the job of programming a computer. In a sense this terminology is fortunate, and in a sense it is not. The term programming is appropriate, in that it does imply the great amount of detailed planning which the programmer must conduct in order to write the educational materials in this special way. Programming in this sense is a much more detailed planning of the lesson than is represented in course outlines, daily study plans, and so on. Thus the analogy to computer programming is well taken, in that the specific output in terms of the learned performance of the student must be known, and the appropriate input must be made in order to achieve the desired output. However, the job of programming of automated material is more hazardous perhaps than that of the computer programmer because of the fact that the computer programmer may be well aware of just what kind of computer he is dealing with, and he may have block diagrams and schematic diagrams to help him determine which kinds of input will achieve the desired kinds of output. Unfortunately, here the analogy breaks down insofar as the automated programmer is concerned. It is not so much that the programmer does not know the behavior or the accomplishments he wishes the students to have, and it is not so much that he is perplexed as to the raw material inputs for the program; the catch is that he does not have the schematic or block diagram of the student's head. Thus, programming is perhaps more appropriately termed an art than a science and because of this inexactness in our understanding of the circuit structure of the student's head and the exact nature of learning itself, it is not surprising that we have several schools of programming developed.

PRESSEY'S METHOD OF PROGRAMMING

The teaching machine movement has its beginnings in the work of Dr. Sidney L. Pressey at Ohio State University back in 1925. Dr. Pressey was interested in effective-study courses and in means for helping students achieve more learning by their own study. Notice, then, that the beginnings of the movement did not deal with the instructors' lectures or the writing of textbooks; it dealt rather with ways of helping the student get the most out of his own private study of the textbook material. Pressey observed that students often, having completed the reading of a chapter in a textbook, have no adequate way of knowing whether or not they have mastered the material and have understood the lesson. Pressey therefore sought some means to enable the student to ascertain whether or not he had learned well, and if there were deficiencies in the learning, to assist him in overcoming these. Pressey therefore developed self-instructional tests over each chapter in the textbook. The student's procedure then was to read the chapter during his own study period and then to take the practice test to determine how well he had learned. These practice tests were primarily of the multiple-choice or true-false form, but the distinguishing feature of them was that immediately upon responding to each question, the student received knowledge of the correctness or incorrectness of his answer. Thus, the technique is not unlike the giving of daily quizzes, except that it automatically scores the student's work and informs him of his success and thus relieves the teacher of a great amount of clerical detail and paper grading. Probably more important is the feature that the feedback is given immediately, not a day or two after the test has been taken. Thus, Pressey's first use of a simple teaching machine was to do the scoring automatically and to indicate immediately to the student after each response whether his answer was right or wrong. The machines were quite simple and had nothing to do with the original preparation of the material as found in textbooks. Thus, Pressey was not attempting to replace textbooks with specially programmed material; he was seeking rather a convenient aid to effective study to help the student know when he had learned well. However, the answers to the questions were scored; wrong answers became the focus for class dicussions and further explanation by the teacher. Thus, teaching machines originally were not a replacement for the textbook, the lecture, or the student's study; rather they were guides to the study and they became a focal point in the integration of all the various methods the instructor used to get the material across. Recently Pressey has named his method of use of teaching machines as adjunct self-instruction, indicating that it does not replace lecturing and other classroom procedures as methods for presenting information, but that it does accomplish effective review and drill.

Pressey's teaching machines and their practice tests were employed by him and his graduate students in many experiments in education, both in the normal classroom and in special classrooms where groups of superior students gathered together for independent study with less guidance from an instructor.

EARLY TEACHING MACHINE APPLICATIONS IN THE AIR FORCE

Years after Pressey's first teaching-machine usage, as described above, a group of research psychologists working for the Air Force Personnel and Training Research Center, during the 1950's, became interested particularly in more effective training for Air Force electronic technicians. This group of researchers, including, Dr. Robert M. Gagne, Dr. Arthur A. Lumsdaine, Dr. Joseph E. Tucker, Mr. Norman A. Crowder, Dr. Robert S. French, and myself, actually were working to combine two arts into military training. On one hand we were utilizing the principles of the teaching machine as derived by Pressey, and on the other hand we were utilizing the state-of-the-art in simulation for training purposes. I am sure you are all familiar with pilot simulators. In our case we were working with maintenance-training simulators. We had to have equipment for the man's hands to practice on, but we had to combine this with equipment to establish the knowledge components of the skill. This Air Force research program produced a great variety of teaching machines and simulator devices. Many of the products developed by that program are summarized in the recent book edited by Lumsdaine & Glaser.[1] It is in the context of this training research program that Norman Crowder first developed his so-called intrinsic method of programming and it was first applied in a particularly appropriate subject matter, namely the teaching of trouble-shooting to electronic technicians. Since trouble-shooting involved not following one straight fixed path to the goal, but the learning to think of many logical alternative paths, and since it involves the elimination of trouble sources by split half methods of eliminating possibilities, the branching type of programming which Crowder developed was uniquely appropriate to this problem. Thus, although Crowder is now employing this intrinsic programming method for many forms of academic and technical subject matter, it is interesting to note that the branching characteristics of it did arise from the requirements of the subject matter in teaching electronic trouble-shooting.

CROWDER'S METHOD OF PROGRAMMING

Crowder's method of programming goes beyond the original practices of Pressey's. That is, in Crowder's method there is no separate textbook which is used as the first source of information followed by the self-instructional tests. Rather, Crowder rewrites the textbook material and presents it in such sequences that the student first reads a paragraph or two of technical information and then answers questions. The machine notes whether the student's answer is right or wrong, and if right, the student is allowed to proceed to the next item of information. However, if the answer is wrong, the student is so informed and he may be shown why he is wrong. For example, in the trouble-shooting material, if a student pressed the incorrect button on the machine, the machine would instruct him to turn to a certain frame or page in the program material. This frame would say something like this, "Now look here, sonny, the reason you got this answer wrong was that you just don't understand what the tracking loop is all about. Now let's go back and review the function of the tracking loop and then we will ask you to make another response to the question." Thus, Crowder sort of jollies his student along by interacting with him much as a coach interacts with a pupil. Thus arises the term "coach-pupil method." An important characteristic of Crowder's method is that not every student reads the same material and answers the same questions. To be sure, there is a basic sequence of material to be mastered, and the quick-learning student goes directly from one page of information and its response to the next page of information and its response. However, when a student makes an error, branching comes into the picture; that is, since there are several possible ways of being wrong, the answer chosen by the student determines the particular corrective feedback information which Crowder will supply. In contrast, other methods of programming present fixed sequences, and they are able to be fixed because special effort is made to be sure that the

[1] Lumsdaine, A. A. and Glaser, R. (eds.) *Teaching machines and programmed learning: A source book.* Washington, D.C.: National Education Association, 1960.

student never makes an error. Crowder, on the other hand, is not overly concerned with an occasional error, and he even goes so far as to occasionally lead the student down the primrose path so he can feed him an effective dose of well-written remedial instruction.

Thus, it is clear that Crowder regards teaching by automation as primarily a process of effective communication. Crowder's first reason for asking questions is to find out whether the communication has been effective, that is, whether the student has indeed learned well. Crowder's second reason for inserting questions is that the response to a given question determines the next step of information to be presented.

SKINNER'S METHOD OF PROGRAMMING

In contrast to Crowder's method, one method now current, and perhaps the most widely used, is a method of programming developed by Dr. B. F. Skinner at Harvard. Dr. Skinner began the conceptual work for his methods of programming by his research with animal performance in the laboratory. Since he could not effectively use language to tell the animals what he wanted them to learn to do, he resorted to reinforcement as a method for shaping of the behavior desired. The technical details of this so-called shaping of behavior are quite involved and may be found elsewhere, but it is important to note that there is a great difference among the conceptualizations of learning held by Pressey, Crowder, and Skinner. Pressey and Crowder describe learning largely in terms familiar to teachers and educators, that is in terms of effective communication and proper student responding. Student activity is stressed in all methods of programming, but Skinner conceptualizes learning as the shaping of the desired behavior, bit by bit and step by step, through the process of reinforcement. In Crowder's method of programming, great attention is paid to the clarity of communication in the written material For Skinner, the only excuse for the written material is to evoke the desired responses from the student and to evoke these responses under all of the appropriate circumstances required by the learning objectives. This behavioristic view of learning of course is drastically different from the more educational rationalistic view of other programmers. These differences in conceptualization of learning do show up in the methods of programming. For example, Skinner's method presents much less information than does Crowder's before requiring a response. Skinner may present only one sentence in which one word has been left blank; he requires the student to read the material and to fill in the blank word. The objective is the student should almost never make an error and by going through the carefully prepared small steps in which only a little bit of progress is made at a time, should gradually develop the desired criterion behavior.

To elaborate further on the contrast between effective communication and behavior shaping as the key to successful programming, and to contrast further the behavior shaping approach to the communications approach, I would like to quote a passage from Crowder.[2]

> "We who work with intrinsically programmed devices do not have access to any educational philosopher's stone. Rather, we suspect that human learning takes place in a variety of ways and that these ways vary with the abilities and present knowledge of different students, with the nature of the subject-matter, with a number of interactions between these sources of variation, and with other sources of variability of which we are not even aware. Why, then, do we presume to build "teaching machines" at all?
>
> "The answer lies in the feedback control which is inherent in the intrinsic programming method. To predictably achieve a desired result, one must either have an infallible process to bring about the result, or one must have a means of determining whether the result has been achieved and of taking appropriate action on the basis of that determination. This latter capability is the basis of the intrinsic programming, or automatic tutoring technique . . ."

SOME CHARACTERISTICS OF AUTOMATED PROGRAMS

Having described programming as it began with Pressey's early work and then developed further by Crowder and Skinner, we might attempt to summarize some characteristics of programming which are moderately accurate in describing all

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[2]Crowder, N. A. "Automatic Tutoring." *Feedback*, 1961, *1*, 7.

the programming methods currently used. Thus, the characteristics enumerated below may more accurately reflect one programming technique than another, but in general these are the features of programming:

1. Only a small unit of information is presented before requiring a response from the learner.
2. Successive units of information are presented only after student responses indicate understanding of the preceding unit.
3. The student is informed after each response that he is right or wrong.
4. The student is usually right, due to the careful ordering of the steps and to the impossibility of going long without errors being detected and corrected.
5. Understanding and retention are developed by presenting frequent review of information and by presenting main points in many contexts to avoid rote memorizations.
6. Student motivation is maintained by the continuous experience of success.
7. Mental indigestion is avoided; each student works at his own rate, and he never goes to the next item until he has mastered the preceding item.
8. In some programs the specific information presented is selected on the basis of differences in students' learning rates so that not all students must receive the same information nor take the same path to the goal.
9. Programs are tried out experimentally and modified before normal use. Sequences which give trouble to the student in the tryout are rewritten before publication. Thus, programs are pretested on the basis that students have been found to respond successfully to all items.
10. Testing of the student is accomplished every minute or two, not every month or two.
11. Once a program has been tested it may be employed routinely as a teaching-machine program, but the same pretested material might be presented in book, workbook, lecture, or television form with considerable success.
12. Teaching machines thus control both the material and the method. They interact with the student on an individual basis. They do much more than to present information. They intersperse problems to be solved with principles to be read and understood.
13. The instructor is free to do more individual work with students. He depends on the machine for the learning of basic information. Group discussions and laboratory exercises are more incisive as all students enter into these activities with adequate grasp of fundamentals.
14. As in television instruction, the best professional programmers, teachers, technical writers, and subject-matter experts prepare the program. Deficiencies of the teacher do not impede learning in automated instruction as seriously as they affect learning in normal classroom procedures.
15. Successful teaching-machine applications have already been made in education and in military and industrial training. Uses go beyond academic learning. Job training simulators may employ teaching-machine principles.
16. The main effort and expense is in program development and tryout. The cost of the machines for conceptual learning is minor.
17. The machine may provide an extra interest and convenience, but the program stimulates the effective learning by the responses evoked.

ALTERNATIVE PROPOSALS FOR LEARNING BY READING

By way of review of the discussion so far, and to place some context around the subject of teaching machines, we might say that during the last twenty years within education there have developed three rather drastically different concepts as to how reading contributes to student learning. First, we have the speed-reading advocates who believe that the faster the student can read the more material he can cover and thus the more he learns. Second, we have those who have developed effective study methods, which concentrate upon methods by which the student can get most out of the written information presented, by way of outlining, reviewing to himself, etc. We have seen that Pressey's method of programming more or less fits in with this effective-study effort. Third, we have present-day programming techniques as represented by Skinner. Reading in these programs is intended only to set the stimulus context for getting the responses made which are collectively shaped into the desired criterion behavior. The first of these three viewpoints almost assumes that what is read is learned. In contrast, Skinner's method of programming does not make much of the material the student reads but rather of the responses that are made and reinforced. Thus, we have the contrast again between the communicating aspect of learning and the behavior-shaping aspect of learning. I am sure that most of us would agree that reading is a very significant way to learn, but we also will admit that even the most effective communication by a good lecturer or a good textbook writer is of little avail unless the student makes some kind of effort. Usually this effort is implicit, but by programming methods, much of this effort requires explicit or overt performance. Thus, programming, in a sense, combines the art of communication and the point of view that one learns by doing, not through absorption.

POSSIBLE APPLICATIONS TO TECHNICAL WRITING SKILLS

Now I have deliberately used up most of my time in order that I would not have much time to comment specifically upon how programming can be used in the training of technical writers. The previous two speakers have outlined the role of the university and the role of on-the-job training in development of technical writers. This account of automated instruction has been presented under the context of how to study at home, although much of our emphasis has been upon education and military training.

As unfamiliar as I am with the process of technical writing as known to your profession, I would not wish to represent the following offhand views as carefully studied recommendations on the application of programming to your problems. However, in general, it does seem to me that programming has been shown to be effective in a sufficiently wide range of knowledge and skill development areas to have the strong suspicion that it would help with your problems. For example, a programmed textbook entitled *English 2600* has recently been published by Harcourt Brace. This is a programmed textbook covering many of the fundamentals of English, grammar, punctuation, etc. It seems to me that approaches like this can be used to get better mastery of the fundamental skills of writing which have always been set forth in textbooks and standard references. If the fundamentals can clearly be set forth, programming is very likely appropriate for the development of these basic writing skills. However, it also seems equally apparent to me that there will probably never be a substitute, in your area, for the instructor's criticism of the work samples of writing which the student produces. Thus, I do not see how teaching-machine instruction would ever supplant this practice of the student in writing and the personal criticism and review of the sample by the teacher. On the other hand I do believe that the basics of English composition could be much better taught by programming than they often have been by normal classroom methods. These comments of course pertain primarily to the fundamental writing skills. I have no disagreement whatever with the previous speakers in regard to the educational background which the university may supply, and I certainly agree that special efforts of on-the-job training such as described by the second speaker are likely to be invaluable supplements to the school training. I do believe that in formal training, as well as in on-the-job training, and in study at home, teaching machines do offer some promise for the improvement of instruction in the technical writing field.

The question of evaluation of new techniques such as programming arises. There have been a good number of experiments carefully controlled and with student learning carefully measured for comparing the effectiveness of teaching-machine instruction with instruction by the usual procedures. A good many of these experiments are described in the book edited by Lumsdaine and Glaser. Presently under way in many colleges and public schools are efforts to program parts or all of the material for a complete semester's work. As experience accumulates in both laboratory and field tryouts, we will gradually have a better sense of which programming techniques work for which subject matters, and the extent to which other conventional methods ought to be combined with programming, rather than relying upon automated instruction alone. However, to the extent that automated instruction is effective, we also reduce our need for remedial instruction. That is, when programming has been done as carefully as it can be done, say in high school English composition courses, the over-all effect of this should be to relieve university faculties of the heavy burden of teaching substandard or refresher courses before the students are capable of encountering the normal English composition course. In this connection more ambitious experiments than those summarized in the book by Lumsdaine and Glaser are now underway, and eventually, no doubt, there will be attempts to program say, all four years of high school English training.

SUMMARY

For a wide range of academic, vocational, and skill training objectives, automated instructions has already been found in controlled experiments to represent gains in learning and considerable savings in class time. However, there is no one programming method or one machine which I could recommend for all learning problems. Nor do I believe that in public education and elsewhere the machine will be allowed to substitute for the personal interaction between student and teacher. On the other hand, the machine does offer a way to free the teacher of the burden of teaching drill material by repetition, and of the laborious task of grading daily quizzes. The use of teaching machines can ensure that the basic material is mastered before discussions are undertaken, thus making the discussions more incisive. In other words, the teaching machine will not replace the teacher, at least in the foreseeable future, but it can assist in freeing her from much drudgery.

PANEL 3 — TECHNICAL PUBLICITY — HOW TO ACHIEVE COOPERATION BETWEEN THE TECHNICAL MAN AND THE PRESS

WHAT THE TECHNICAL MAN EXPECTS FROM THE PRESS

by Peter Sherrill
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The technical man, as a technical man, is concerned more with the trade, technical, and academic press than with the metropolitan or local press. However, he tends to regard the trade press with suspicion and wishes it offered more technically oriented interpretive reporting. The trade press reporter, on the other hand, avoids interpretive reporting, often turning to the technical man in industry to write for him or supply material in quotable form. Budget limitations restrict the trade press reporter from seeking out the technical man. Nowadays the trend is for industry to employ an intermediary to work between the technical man and the press. Thus the voice of the individual is being lost, except in the highly technical and academic press.

The technical man, of course, views the press in relation to himself in a variety of ways. In this regard, he is no different from millions of other people who come in contact with news media or trade media every day of their lives. The press we refer to for the purpose of this discussion is the general complex of printed news:

1. The metropolitan daily press.
2. The local daily or weekly press.
3. The trade press.
4. The popular technical-review press.
5. The profound technical and semi-academic press.
6. The purely academic press.

The approach to these various segments of the press varies considerably. As human beings we enjoy enormous variety in our press fare. Since my viewpoint, however, must be confined to that of a technical man and not that of a male voting American economic unit, I must, therefore, view the press through a very narrow window. I must also view it in terms of what I seek to find in the press:

1. Technical articles of lasting significance.
2. Product articles on new devices.
3. Product news.
4. Technical news.
5. Personnel news.
6. Career opportunities.
7. Special axe grindings.

1. Metropolitan Daily Press

The technical man expects from the metropolitan daily headlines of news-making achievement. He probably views the science column in a large metropolitan paper in a way no different from the columns of Alsop, Drew Pearson, Dear Abbie, Howard Taubman, or Leonard Lyons. In other words, the science or technical part of the metropolitan paper is not directed at the technical man as a technical man. And the technical man could feel that he as a reader deserves a more concrete technical diet.

In some papers science reporting is the dog beat. And the science reporting comes off the wire.

2. Local Dailies

I'm confident that the view of the technical man toward the local paper is a source of meeting notices for his society of special interest.

3. The Trade Press

It is in his approach to the trade press that the technical man's view is most colorful. It is here that the technical man's view is most concentrated as a consumer reader. In fact, he probably views the trade press in the same way that he views the metropolitan press in his role of a male voting American human being. In other words, he has feelings about the responsibility of the press; he has feelings that the press does or does not meet its obligations. He has the same reservations and enthusiasms about the trade press that the average citizen has about the daily paper. Since this is an important area of discussion I will return to it.

4. The Popular Technical-Review Press

The technical man's attitude toward the technical-review press is much less suspicious than his attitude toward the trade press. If he is reasonably dedicated, he uses it frequently to find out what's going on in other scientific disciplines and in other areas of engineering.

5. The Profound Technical and Semi-Academic Press

He greets this segment of the press with practically no suspicion, some enthusiasm, and considerable respect. For it is here that the notable contributions are made. It is here that he is able to read of sincere work being done in his field of interest. The work would not make headlines in the metropolitan press. It would not be mentioned in the local press. It receives no attention from the trade press; occasionally explanations of work coming from the profound technical press are popularized in the technical-review press. So we must assume that it is an important area of his reading.

6. The Academic Press

Of course his attitude toward the academic press is one of even greater reverence for it represents the source of his present knowledge.

One could probably say that all aspects of the press are clearly understood by the technical man — as a technical man — with the exception of the trade press.

Just as the average citizen has suspicions of the daily press as exemplified by the old battle-worn cliche, "you can't believe what you read in the papers, etc.," the technical man is not completely without reservation when he reads things in the trade press. Because his specialized technical knowledge in his field gives him an insight into the value and significance of products and ideas which are presented on its pages, he is able to evaluate more critically the job it tries to do. Thus, he too frequently echos that same cliche, "you can't always believe what you read in the trade press." He frequently echos the average citizen's demand for more interpretative reporting from the metropolitan press. The technical man would like to have more sound technically oriented interpretative reporting in the trade press.

Elmer Davis, one of the country's great news men, pointed out some years ago in his book *But We Were Born Free* the dangers in holding strictly to the ideal of objectivity in reporting. It is this ideal which confuses the technical man when it is applied to the trade press. Elmer Davis explained that objectivity is really a convenient screen of one-dimensional truth which protects the hard-pressed reporter and obliges him to put quotation marks around what he knows to be misstatements, simply because the statements were uttered by someone.

All members of the press, however, are aware of the hazards that surround interpretative reporting, and seem to avoid interpretative reporting wherever possible. The trade press reporter seeks to avoid this difficulty and responsibility by asking the technical man from industry to write an interpretative piece for him. Or at least he asks the technical man to supply most of the material in a quotable form. The trade press reporter very often checks out the material which he has received by asking someone else, generally a competitor, to verify the accuracy and significance of the information he has received.

The question the technical man properly asks today is: Does such a procedure produce the knowledgeable objectivity which he seeks from the trade press and which the trade press professes to seek?

The technical man's view of the trade press is, of course, the result of his exposure to the representatives of trade magazines and journals whom he sees. The truth is that the technical man rarely sees the reporter from the trade press. This is not the fault of the technical man. He is not inaccessible. Even though he knows he is referred to as a square and a long hair by many reporters from the trade press, he is not nearly as inaccessible as the budget for the trade press reporter. To do an effective reporting job, the trade press reporter must be mobile. He must get around and talk to technical people in the field. The truth is, of course, he does not. He is immobile. His traveling budget is extremely limited. And the technical man is lucky in this city to see a representative from the two biggest electronic trade magazines once a year, if ever.

The reporter's view of the technical man as a square and long hair is supported by the view expressed frequently in the columns of your own societies' publications. There the technical man is viewed as an inarticulate, illiterate square, who is unable to write his own name clearly, who fails to recognize the needs of the consumer, and who fails to recognize the needs of the press. This may be true.

But, it is possible that the trade press reporter fails to recognize the needs of his consumer — and simply passes the blame one stage back, as a kind of journalistic hipster playing to other gypsies in his profession.

When all is said and done, however, while the technical man usually finds less than he expects to find in the trade press, just as the average citizen finds less than he expects to find in the papers, he does find enough exciting to lure him back issue after issue. Perhaps, like any critic of the newspaper press, he is driven by that uncontrollable American compulsion to know what is going on. (Does he ever find out?)

In the last decade, there has been great need in industry for an intermediary to work between the technical man and the press. It is significant to note that the technical man has views toward the intermediary as well as views toward the press. He has come to view the intermediary as really a member of the press. And in many areas he feels that the intermediary would be working for media if he could afford to, rather than for industry. For if the intermediary understands the problems of the engineer and scientist and also understands the problems of the press, he should belong to the press. However, contemporary economics have forced companies to pay for this function because the press pays too little, and industry wants its voice.

Today the voice of industry is heard nearly on its own terms because it affords those wonderful skills which give it a voice.

The technical man today is a member of a larger complex than the press. His world has more segments and his individual voice is lost except for its expression in the highly technical and academic press. The voice he has to the technical world is the voice of the company or the voice of the organization. He understands why this is true and certainly agrees that the large technical organization should have one voice.

He might wonder whether or not the unchecked lineage crushing him as the uninterpreted one-dimensional voice of the trade contains the seeds of danger.

According to Elmer Davis, it took the danger of the McCarthy hearings to bring realization to the general press that it could not report one-dimensional truth unrestrained. Other dimensions are required for real communication. Let us hope it does not take a catastrophe to move our own communication farther along the road to responsibility.

WHAT THE PRESS EXPECTS FROM THE TECHNICAL MAN

by **Jack Allen**
Science Editor, ***Examiner***
San Francisco, California

The lay daily newspaper is a money-making enterprise in a free-enterprise system. As such it must appeal to a wide audience and therefore must report science in what may seem like kindergarten terms. In the last ten years the public relations man has come into being. From the press standpoint he functions because there is too much science to report without guidance. From the industry standpoint he serves to create a company image. The PR man provides the press with ideas, releases, news of meetings, but often fails to provide access for the press to the people they want to see. Frequently scientists are afraid to talk to the press for fear their stories will not be reported properly or they will be chided by colleagues. One of the most important things science people could provide would be a group of experts to be on tap for the press as a source for checking facts.

Quite obviously I cannot speak for the various sorts of publications Mr. Sherrill mentioned, but rather only for the lay daily newspapers. I am asked to answer the question, "What the press expects from the technical man." I answer that briefly: We would like a new chemical element, a control of nuclear fusion, and perhaps a cure for cancer on alternate Mondays. This would be an ideal situation.

On the chance of overstating the obvious, I had better get on the record what a daily newspaper is. It is a money-making enterprise in the free-enterprise system. Unlike many universities and companies out of which research comes, we are not supported by the Department of Defense, or NASA, or any other group. We have to make our own way. As a consequence we have to appeal to a very wide audience to get sufficient advertising to remain a money-making and functioning unit in a free-enterprise system. This means we must inform, entertain, and I hope educate a little bit along the way.

Whenever I write a story about science I still have to think about the roughneck workman who reads nothing but the sports section, the comics, and perhaps an occasional piece on science; and the professor of English who reads nothing but the drama reviews, and the comics, and perhaps an occasional bit of science writing. This is just to indicate why we have to spread things a little thin and why it is necessary to talk about science in what to you must seem kindergarten terms.

Any discussion of science writing in the lay press and our relationship with scientific or technical men must take into consideration the public relations man who is the liaison man between us. When I first began to write science ten years ago we were still reporters. We went out and found our stories, and there were no public relations men trying to create an image of a company. It was harder and in some ways it was more fun. I don't know that the PR man is there because we are lazy. I think he is there, from our standpoint, because there is so much science to cover we couldn't possibly get around to all the stories without some guidance.

Of course from the company's standpoint the PR man is there to create a public image of a company so that when some of its officers go to jail for fixing prices they will get a better press as a result. I think PR men are also there because the companies and universities have become aware that they owe something to the public because most of their funds come from tax dollars now. This seems to be a fair exchange.

In some respects PR people are both a nuisance and a great help. They serve two functions: one is to go from you to me with ideas, handouts, written releases, news of meetings; and in general this is good as tip-off stuff. But I think where they fall down is in their other duty: that of providing access for us to people we want to see. Perhaps this is our failure to ask the right questions of them and to make the right demands on them.

Each science writer that I know of builds up his own "stable" of experts in the various fields. Sometimes this is difficult to do, as often the scientist does not want to talk to us because he is not convinced that we will report what he says properly. He is not naturally shy, but he is afraid of his colleagues mostly. I am convinced that the reason most scientists fail to communicate is just because the next day at lunch one of his colleagues might say, "I saw your ad in the paper last night, Joe; nice going!"

This has happened in the medical profession, and as a result the medical societies have found it necessary to say, "It's all right for you to speak freely. You can say you did it as a spokesman for the medical society." By a stable of experts I mean people to whom I could go or phone at the last minute with deadlines in mind and say, "Look, Joe, I have a wire story here out of the east. I don't want to quote you, but just tell me if it's a phony or not." Or, "I have a local story somebody gave me; it doesn't smell right; tell me whether this guy is going down the right track, or whether the public ought to be aware of what he is working on."

I am asked to say what the science writers want from technical men. I would say that one of the most important things that science people could build up would be a group of experts that would be on tap for the press at all times. They could remain anonymous if they wished, but would serve as sources to check facts against. Hopefully, they would be people we would know could talk objectively and would be in a position to assess the work of other people.

Examples of troubles we run into: We are constantly plagued by political and sociological matters creeping into scientific stories. How do you go about writing a story on a debate without taking sides between Edward Teller and Linus Pauling on the cessation of nuclear tests? Do you lay them down side by side or what? Do you examine Edward Teller's Hungarian background and Linus Pauling's leanings? Here is one of the problems we have to face every day, and if we get over on one side or the other we hear about it, if not from our editors then from our readers.

The psychiatrists tell us that most scientists bear a heavy burden of guilt and that a lot of the things they tell us are meaningful only in this context. I don't know how we could get this idea over in a story with all its necessary interpretations. But in general, we do have to assess for our lay reader what the importance of a story is. It isn't sufficient to say that some scientist proposes that we redo the atmosphere of Venus by seeding it with plant life which will absorb the carbon dioxide and produce oxygen so that man can go and live there. This was said seriously. We're supposed to turn this story into something with which the reader can identify himself, so you immediately have to get a man on Venus. Now, this outrages the scientist that we should go so far as to propose this. Yet to me this makes sense. It certainly attracts the reader, is likely to make him read the rest of the story, and make him understand a little more about photosynthesis — if nothing else.

I think these are legitimate. These are the things a newspaper must do — sugar-coat the hard scientific facts you report. Unless you *do* sugar-coat, nobody is going to read it. Maybe this is the argument that if it can't be read, it shouldn't be written. But one of the functions of the newspaper is to satisfy the curiosity of its readers. And one of the functions of a scientist is to report as quickly as possible his findings for the public for whom he is actually working in terms of tax dollars, and, theoretically, his whole career is devoted to the forwarding of the human race.

THE TWAIN SHALL MEET

by Walter Bonney
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An excerpt from the book Moments of Discovery states that because our lives have been revolutionized by scientific discoveries, everyone needs some understanding of science. The man in the public information field serves as the transmission link between the producers of technical and scientific information and the press reporters. He has to make the technologists understand what the reporters want, and that it is important that their stories be told, in words familiar to the readers. Often words have conflicting meanings, not only in technical usage, but also in dictionary definitions. When technical people talk to reporters, they should be prepared to explain their projects in terms that can be interpreted simply and clearly.

If the twain shall meet. Up until the time that I came into this room I was convinced that the twain could meet and that they must meet. After hearing these prophets of doom and gloom I am not so sure.

I would like to quote a paragraph that I read the other evening in a two-volume work called *Moments of Discovery*. I think it is a work that writers about technology and science should have. It is a work that the technical writers themselves might have because it is a collection of writings by some of the great scientists of the world over the last two or three thousand years, and for elegance of language and clarity of thought it is something we all could aspire toward.

> "Every aspect of our lives, the food we eat, the clothes we wear, our methods of communication and transportation, the ways of waging war, the conduct of relations between nations, each of these has been revolutionized by the discoveries made by scientists. Even our philosophical attitude toward the world as a whole has been changed in ways of fundamental significance to the understanding of the nature of man in relation to his environment. Hence everyone that lives in the world needs to have some understanding of the nature and effects of science. Many scientific discoveries, perhaps most of the significant ones. Represent feats of imagination, insight, and originality. The creative scientist lives in order to enrich our world by increasing our understanding of it."

Now here is this man in the middle, this transmission link (hopefully) between the producers of technological and scientific information on the one hand and reporters, whether for the general press or the technical press, on the other. Men in my job at best serve as a good transmission link.

Sometimes when we start feeling proud of ourselves, which if we're honest is seldom, we also serve the useful purpose of being something of a public conscience, hitting at both sides to see that more of this story that I just quoted is told. Speaking of the technical people within our own organizations, we have to make sure that they know what the reporters want. And I submit that the reporters want (I really do think they want — but if they *don't* know they want, they should somehow be encouraged to *get* this want), that they *want* to tell the exciting story of what is happening in science and technology, what it means to the average person living around the world or to special segments of the people living around the world. Admittedly, as Mr. Allen has said, the story has to be told in short takes, at most a few hundred words; it can't be told in volumes. It has to stress the novelty of the information being presented, hopefully has to have headline material in it or it won't get read. Now this is a sort of thing that a man in my job has to get the technologist to understand — that it *is* important that his story be told, not for self-serving interest, but because it is important in the more total sense.

A second point — we have to make sure that the technical people tell their story in English. I am not blessed with a technical education. So I have to think in terms of words that I can look up in the dictionary and then try to piece together the meaning.

Let me give you an example or two of what I mean. Some of these examples, incidentally, are not specifically the faults of the technologist or the scientist, but the faults of the dictionary writers themselves. In this large area I use the word "biweekly." Biweekly means two things — every two weeks or twice a week. For precision writing and precision understanding I have finally come to use semiweekly when talking about twice a week. Or take the word "scan." Scan can mean as in an oscilloscope that looks point by point, word by word, at things, or also in the dictionary sense it can mean to skim, to go right over so quickly that you get just the faintest understanding of it.

Those are two general words, but take the word "damage." Here is a word that according to the dictionary means injury that lowers value or involves loss of efficiency. Now several years ago I came face to face in an uncomprehending way with the use of the word "damage" by the scientists. At that time I was with the old NACA, the predecessor to the Space Agency. At their research center in Cleveland they were doing some very interesting work growing crystals. Then they subjected the crystals to radiation and told how fascinating and significant this experiment was and something about the "damage" that occurred.

I asked if that spoiled the crystals and they said, "Oh no! Sometimes it makes them better; it strengthens them!" I naively asked how they could damage something and have it come out *better*. It turned out that they didn't mean damage in the way ordinary mortals mean it; they meant it in their own technical shorthand.

If we're trying to communicate with other folks we have to use words in the meanings that they have in their heads, not in private meanings that we have agreed on among ourselves.

"Subjective," the dictionary says, is exhibiting or affected by personal bias with emotional background. Well, it's the sort of talk that I'm giving, completely subjective; but Sir Charles Snow says that the scientists use it this way: divided according to subjects. Maybe it does mean that, but to Jack Allen and to the little lady who has to read the *Examiner's* story to her husband who hasn't learned to read yet, subjective in this sense is going to be rather difficult. Or "objective," Sir Charles says, means directed toward an object. I guess that's all right, except the dictionary says: exhibiting or characterized by emphasis upon or tendency to view events as external and apart from self-consciousness. Detached, impersonal, unprejudiced — the sort of presentation that Ed Chester is giving as moderator of this panel.

We also ought to make sure that when technical people are talking to the writers, they know what they are going to talk about. This sounds too elementary to consider, but I am going to give you a jim-dandy little example, again going back to the Space Agency. We had last October, just before I left, a press conference on the scientific results of the Explorer VII satellite. Now Explorer VII was one of the most important of the science-information-gathering satellites that the Space Agency had sent up. We had an experiment on radiation balance, on Lyman-Alpha X-rays, on heavy cosmic rays, on ordinary cosmic rays, on micrometeorites, and on temperature measurements out in space. As was our practice we brought the people who had made the experiments from such places as the University of Wisconsin, Research Institute of Advance Studies of Johns Hopkins, and State University of Iowa to talk about the experiments.

We held our press conference the day after the first anniversary that this particular satellite had been put into orbit. Why? Because we had a new electric timer in the satellite that was supposed to turn off the radio at *exactly* the end of one full year. This, so that the communications bands would not be cluttered up with experiments continuing after a useful period. So we agreed, not knowing the terrible trap we were falling into — because the day after the thing was supposed to have shut off, it hadn't shut off! The technical people said, "Sit tight and be patient; within the next few minutes it will shut off and this wonderful accuracy will be demonstrated."

I might say parenthetically, and this is seven months later, that the timer has still not shut off! So we got into the discussion of how this timer works. Each of the technical men had his own idea of how it worked, and the representatives, technical and PR types, from the manufacturer had their ideas. Not only could they not explain it to the acceptance of the press people there, but they couldn't agree among *themselves* how it worked.

Now again to belabor a dead horse, I say to you that somebody who was participating in that press conference, probably me, should have anticipated and should have gotten a nice simple two-sentence definition of how that timer did work — because this was the thing that finally turned out to be the headline-making aspect of the whole business. The fact that some of the experiments in Explorer VII brought an entirely new understanding of how the aurora is built up got lost and buried and never did get reported to the extent that it deserved.

Let me now go on to another fairly obvious thing we must do. We must make sure that the story is told in black and white and in words without qualifications, in simple terms. Now as Phil Graham, publisher of *Washington Post and Times Herald* has said — it sometimes is necessary to Pogo-ize. Now you are all familiar with Pogo. Pogo says things that aren't so, but in saying them he gives you a pretty good understanding of things as they really are. Example: Vanguard II was a very interesting satellite; it had a scanner that was supposed to be able to take a television picture — about a mile long — of images of the earth. Then you could splice them together and put together a total picture. The only trouble was that the orientation of the satellite toward the earth wasn't the way it was supposed to be. When I went to the people in charge of it and asked them about it they said, "Well, this is because it is suffering precession."

I asked: "What is precession?"

I got a long patient definition that really didn't help me much. Technical people around the Space Agency have pretty low regard not only for writers such as Jack, but for PR people such as myself, so I finally went to the dictionary and this is what I got out of it: "Precession is the act of going forward; the cone traced in space by the axis of the body is called the cone of precession. A change in the direction of the axis of a rotating body as a spinning top or gyroscope; the effect of a change is to rotate this axis about a line perpendicular to the original direction and to the axis of the twisted forces producing the change." The one helpful word or phrase was "spinning top."

So I said: "Oh! Like you wind up a top and get it going pretty good and then it starts to wobble."

They said: "Oh, no! Not wobble!"

"Why not wobble?"

"Because it's precession!"

"Well, nobody that you're going to be telling this story to is going to understand!"

We went round and round, had a press conference, used precession, and no one understood it, which is winning where it doesn't count.

Then about two weeks later we had a royal visit to the Space Agency. Baudouin of Belgium was coming to see us. Among the presentations was one about this Vanguard II and why didn't we get the pictures that the scanner was supposed to give us. The same scientist got up and told Baudouin it was because the satellite was *wobbling* out there in space! So maybe I won after all on that one.

Now another one. We had satellite Echo, the balloon. But it wasn't a balloon because a balloon has something lighter than air that makes it lift. It's a balloon filled with a "vacuum," you might say! And in order to get from the small package that is literally not much bigger around than this water pitcher, and perhaps two and one half times as long, into a sphere 100 feet in diameter, they had about 20 pounds of different kinds of chemicals, and these chemicals sublimated. Sublimated wasn't a word that I was familiar with so I went back to my dictionary and then I asked: "Would vaporize be the same thing?"

They replied: "Not at all, because sublimate means to change from solid to gas, whereas vaporize means to pass through the liquid state on the way."

"Well, would we really be spoiling the whole point of the experiment if we get the idea that somehow this solid turned into a gas and made the thing get fat?" We finally had it vaporizing.

I would like to wind up quoting C. P. Snow and then go to the impeccable source of quotations which I will identify in a moment.

For 48 interesting pages Sir Charles has been telling how the educated man on the one side doesn't have the faintest glimmering about what the scientist is doing and that the scientist doesn't have any communication with other educated people. Sir Charles writes:

> "Closing the gap between our cultures is a necessity in the most abstract intellectual sense, as well as in the most practical. When those two senses have grown apart then no society is going to be able to think with wisdom. For the sake of the intellectual life, for the sake of this country's (Great Britain's) special danger, for the sake of the western society living precariously rich among the poor, for the sake of the poor who needn't be poor if there is intelligence in the world, it is obligatory for us and the Americans and the whole West to look at our education with fresh eyes. This is one of the cases where we and the Americans have the most to learn from each other. We have each a good deal to learn from the Russians. If we are not too proud (incidentally the Russians have a good deal to learn from us too), isn't it time we began? The danger is we have been brought up to think as though we had all the time in the world. We have very little time, so little that I dare not guess at it."

And then for the *final* final — "So likewise ye, except ye utter by the tongue words easy to be understood. How shall it be known what is spoke for ye shall speak into the air." (Corinthians.)

PANEL 4 — AUTOMATION OF INFORMATION PRODUCTION AND RETRIEVAL: ITS EFFECTS AND REQUIREMENTS UPON EDITORS AND PUBLISHERS

THE BEGINNINGS OF AUTOMATION OF TECHNICAL DRAFTING, WRITING, AND EDITING FUNCTIONS

by Charles P. Bourne
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Automation in drafting operations utilizes photocomposing systems for the "typing" of drawings. It is feasible that pattern-recognition equipment may be able to interpret hand-drawn sketches and compose them into finished standardized drawings. In the writing functions, data processing equipment is used to compile concordances, bibliographies, abstract collections, title bulletins, indexes for manuscripts, and other listings. Machine techniques which have been used to analyze legal statutes may conceivably be applied to technical documents.

INTRODUCTION

There is an increasing need for methods or techniques to improve all aspects of the documentation of modern science and technology. These aspects include the work of the author, draftsman, editor, publisher, and librarian. The need for improvement stems from continuing pressures to maintain or reduce documentation costs* and to increase the speed of transmission of information, while maintaining or reducing manual and clerical effort. In addition, it is hoped that new techniques will provide new services to technical workers that potentially could increase their scientific and technical productivity.

In response to these pressures, there has been a steady development of techniques for the mechanization or automation of documentation functions. The developments have been possible primarily because of the general availability of digital processing equipment and the cleverness of a few people who have found ways to use the equipment, and related equipment, for some of the documentation tasks.

This paper will concentrate on the facets of the documentation problem concerned with the drafting, writing, and editing of scientific and technical material. A great amount of effort has been expended in the development of techniques for the mechanization of the storage and retrieval of scientific information, but here we are primarily concerned with mechanization of the *production* of useable information. Other aspects of the production function, such as the possibility of publishing in lesser-used media — microcard, microfilm, magnetic tape, and the like — are covered in other papers of this panel discussion.

In this paper, some techniques for the automation of drafting, writing, and editing functions are described; the paper concludes with a brief discussion of the implications of these techniques for technical writers and publishers.

*It is estimated that approximately 2 billion dollars per year are spent for documentation of our 40-billion-dollars-per-year military budget.

DRAFTING AND RELATED FUNCTIONS

A tremendous number of drafting and engineering man-hours are spent annually throughout the country in the manual preparation of engineering drawings, blueprints, schematics, flow charts, and similar documents. A few innovations have been used to augment the manual process — special templates, preprinted diagrams of common components, simplified drawing methods, and so on — but few techniques or systems have been incorporated to completely replace manual drafting. There are, however, some automatic techniques that have been developed.

One very interesting technique to mechanize the preparation of electrical schematic drawings uses a photocomposing machine with a keyboard that includes the basic electrical symbols. A freehand engineering sketch, drawn on specially ruled paper, is read by the machine operator, who then "types" the sketch on the photocomposer keyboard. The characters are exposed on a photographic film, and the drawing is composed from this sequence of symbols. Alpha-numeric descriptive material is composed on another film. A third film contains the title block. The three films are then superimposed to make the finished drawing or negative.

For organizations that write a large number of computer programs, considerable drafting work must be done to draw the flow charts that describe the operations of these programs. These flow diagrams, which may run to scores of pages for a single program, can be extremely complicated. Several successful computer programs have been written to produce flow charts or block diagrams automatically from a given list of program instructions. The programs even go so far as to label each box to show in summary fashion what variables were involved, what computations were performed, and what input-output equipment was used.

In industries where numerically controlled machine tools are used, the description of a particular part design may take the form of some equations and geometrical statements. Computer programs are available to take this descriptive information and generate the sequence of commands for the machine tool. In addition, programs are also available to take these geometrical or mathematical statements and generate an actual image or engineering drawing on a cathode ray tube display device for subsequent photographing and printing.

An extensive amouht of work has been done in the computer industry to completely automate the major portions of the engineering documentation functions that accompany the design and development of a digital computer. The decision to automate seems to stem from the fact that a large-scale computer is simply too complex to document and control with manual methods, and that manual methods are too slow to be tolerated in an industry where the products are highly subject to technical obsolesence. Of course, one reason for automation efforts in the computer industry is that computer manufacturers have ready access to computers.

Design automation procedures in the computer industry incorporate the following types of semiautomatic functions that are concerned with project documentation and associated clerical tasks:

- Assign all wiring points, component locations, and other fabrication information to the schematic drawings.
- Prepare lists of parts locations and wiring information in such a form that an assembler can use this list instead of a drawing.
- Prepare system block diagrams from the logical equations.
- Route the wiring and prepare a wiring chart and cable listing in such a way as to minimize lead length, while at the same time considering loading and noise effects.
- Accommodate engineering changes to make updated lists and diagrams.
- Generate bills of materials for electrical components from the logic equations.
- Print logic block diagrams from the design information stores on magnetic tape.
- Prepare location charts for the placement of circuit cards.
- Check design errors. (For example, note that two lines from different sources have been given the same name, an improper component has been specified, lines are overloaded, etc.)

- Use the design information to generate cards or tapes for direct input into automated fabrication equipment.

The design automation process is costly. Some of the complete systems, for example, require as many as 120,000 program instructions. Nevertheless, many of the technical drafting, writing, and editing chores have been automated to the apparent satisfaction of the manufacturers.

The automatic generation, display, and printing of diagrams of chemical structures has also been accomplished with data processing equipment.

WRITING AND RELATED FUNCTIONS

It is difficult to find very many specific examples of the complete automation of the technical writing function, although there are many instances where the automatic generation of written material is part of a larger process. One writing task that has been almost completely automated is the preparation of concordances. An exhaustive concordance of the Bible, which required 30 years of effort, was first published by James Strong in 1894. In 1955, a 2000-page concordance of the Bible produced with data processing equipment required approximately 150 hours of computer time. In 1959, a 965-page concordance to the poems of Matthew Arnold, prepared by data processing equipment, required approximately 40 hours of machine time. The study group that prepared the Matthew Arnold concordance states that this is the first of a series of concordances to be prepared with data processing equipment and published by this group. Data processing equipment was also used to develop a concordance to the Dead Sea Scrolls.

A group of scholars and theologians in Italy is presently engaged in preparing a complete concordance of the *Summa Theologica* of St. Thomas Acquinas by means of a punched card system. It is estimated that manual indexing of the complete works of St. Thomas (which contain approximately 13 million words) would take 50 scholars 40 years. The procedures employing punched cards will produce the indexes and concordances in a considerably more accurate manner in about four years with 10 scholars. Employing high-speed, large-scale data processing machines, the time required could be cut to less than a year.

Concordances indicate the places in the text of a body of work where particular words were used. as well as showing a small amount of the text material which preceded and followed the particular words. If the adjacent text material is omitted, then the concordance simply amounts to an index to the terms used in the text. It is easy to see, then, that the first draft of a detailed index to a corpus of text material can easily be obtained automatically. For purposes of word analysis, the same process could provide a list of terms for the subsequent manual preparation of a glossary or dictionary. Ignoring the practical problems of getting the material into machine-readable form — problems that are complex, but by no means insurmountable — this type of program would be very useful for quickly and automatically generating first drafts of comprehensive indexes during the preparation of a manuscript for publication.

Data processing equipment has also been used to construct and update bilingual word dictionaries, primarily for application to machine translation efforts. As a matter of fact, machine translation may also be cited as another example of automation of some technical writing functions. The present status of the work in machine translation is well described in a recent report of the U.S. House of Representatives.

The preparation of bibliographies or abstract collections, which may be considered a writing function, has been completely mechanized in some instances by the use of data processing equipment or other special-purpose equipment to search files of information and prepare lists of references or abstracts of all the material that is relevant to the search criteria.

During the last five years, there has been an increasing interest in techniques for automating indexing and abstracting functions. Although automatic indexing has been attained with a moderate amount of success, it seems likely that writers and editors will be able to surpass machines in the art of abstract preparation for a good many years to come.

But the machines are making progress. Indexes to conference proceedings have been organized and prepared for publication by semiautomatic means by several organizations. Several technical journals are using machine techniques to semiautomatically write and compose title bulletins for publication. *Chemical Titles*, for example, publishes twice monthly a semiautomatically produced bibliography of approximately 100 pages, listing about 3000 articles from about 550 chemical journals.

Machine methods have also been used for composing material for publication. Computer or punched card equipment has been used to generate publication material (e. g., *Index Chemicus*) and listings of many kinds (that is, telephone directories, parts catalogs, computer program listings) which are then used to prepare the reproducible or master print for publication. In these examples, the printed lists from a tabulating machine are used for subsequent reproduction operations. Photocomoposing equipment is also being used to compose similar listings, and even continuous text material, for publication — for example, procedures manuals. Some serial publications such as the *Index Medicus* and *Nuclear Science Abstracts*, are currently being prepared by this method.

A few other current activities that are related to this discussion are the automatic writing of music and television plays; the automatic writing of detailed computer programs from specified tasks (that is, a computer is told to write a specific program by itself); and the automatic compression or abbreviation of natural text material. Some work has even been reported recently on computer programs to systematically generate lists of pronounceable 3- and 4-letter words. In this case, in the interest of good taste, the output was given a certain amount of editing by ordinary humans.

EDITING AND RELATED FUNCTIONS

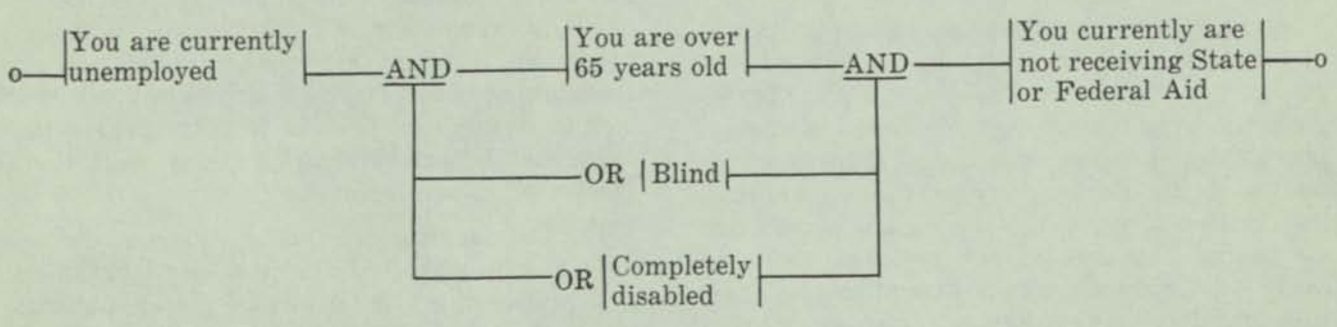
If the routing of published information to the potentially interested parties is considered part of the editor's task, then it can be said that some mechanization has been achieved in this area. Techniques have been developed for a machine system to semiautomatically maintain "interest profiles" for a large number of people, and route incoming material only to those individuals whose profiles indicate interest in particular subject matter.

Several research projects have mechanized some editing functions by doing such things as automatically extrapolating and filling in missing words in text material, and automatically inserting spaces where words had run together. In one instance, 4200 words of text material that had been squeezed together were expanded automatically back into text form with a correction rate of 99.7 per cent.

Andifyoustoptothinkaboutitthisisaprettydarn goodrate.

Very interesting methods have been developed — primarily by Laymen E. Allen of the Yale Law School — for analyzing legal statutes by breaking them down into schematic logic diagrams to show their basic meaning. A very simple example of this conceptual simplification is given by the following fictitious statute:

You are entitled to County unemployment benefits if*:



*If, that is, you can successfully pass through the network. The statute in text form might read, "You are entitled to County unemployment benefits if you are currently unemployed and if, in addition, you are over 65 years old, or blind, or completely disabled, and if, in addition, you are not currently receiving State or Federal aid."

It would seem unnecessary to employ machine techniques to analyze a statute as simple as this example. However, as everyone knows, there are many statutes that are virtually incomprehensible, often with single sentences that run for a page or more. Information processing techniques are currently available that might be able to make sense of these incomprehensible statutes, without the help of a Philadalephia, or any other, lawyer. Consider a semiautomatic editing system in which legal statutes drafted for legislative bodies are first submitted to a machine editor to generate logic diagrams of the form illustrated above. The logic diagram could then serve as a "check print" for the person who drafted the legislation, to make sure that the text actually says what the draftsman really intended to say (or, if the legislator wasn't quite sure what he had in mind in the first place, the logic diagram might help him pull his thoughts together). Once the thought and the formulator of the thought were in agreement, the diagram could accompany the text and be published with the text so that anyone who had occasion to read the statute would have it presented in a very concise and unambiguous manner — a consumation devoutly to be wished.

It may well be that commercial publishers will soon find it profitable to publish manuals of diagrams such as these to accompany the publication of laws or discourses on active fields of legislation — particularly tax legislation and the rulings of the Federal regulatory commissions. Anyone who has ever tried to penetrate the farther reaches of these legal jungles ought to be happy to pay a fair amount of money for a moderately good map.

It is unreasonable to expect complete coverage of all of our statutes in the near future, for the magnitude of the task is staggering; it is estimated, for example, that, in 1960, approximately 14 million words of Federal statutes were published. However, machine analysis of legal statutes seems to hold great promise for the future. And if machine analysis can simplify ambiguous or needlessly complex legal documents, there is little reason to believe that the same approach cannot someday simplify ambiguous, needlessly complex, or ill-thought-out technical documents.

IMPLICATIONS OF THE AUTOMATION OF INFORMATION PRODUCTION

It is unlikely that the growing automation of information production will throw many publication specialists out in the street — at least in the near future. At the moment, data processing equipment is superbly fitted for exhaustive, but essentially mechanical, tasks. It will undoubtedly be many years before machines acquire capabilities akin to human judgment, discrimination, and creativity.

Things may change, though, in our lifetime. Computers can compose music that is as intricate and difficult, if hardly as good, as that of Bartok and Stravinsky; they can write TV scripts that are not much worse than many of the shows on the air; they can now beat almost any of us at checkers; and they are beginning to play a pretty good game of chess — better than most beginners play. It is possible that the day may come when machines will be able to take a manuscript — or even the raw data — from a scientist or engineer and turn out a fairly respectable technical document, complete with illustrations.

But producing a complex report by machine is probably in the relatively distant future — perhaps 15, 20, or 30 years away. At present, writers, editors, and other publication specialists should learn how and in what circumstances the techniques described can be used to advantage in the near future; they should be aware of what machines can do and of what human workers must contribute to a man-machine system.

For example, special methods of writing and editing may be required to take advantage of the automated systems described, as well as for some of the newer mechanized systems, such as teaching machines. In addition to the change in processing techniques, it should also be recognized that there will be changes in the actual media of publication. That is, there will be an increased use of such things as magnetic tape, microfilm, paper tape, microcards, and other forms for direct publication and dissemination.

Specifically, it seems likely that drafting operations will see an increase in the utilization of photocomposing systems for the "typing" of drawings. In addition, it is not too unreasonable to expect pattern-recognition equipment that can look at simple hand-drawn sketches, interpret them, and then compose a corresponding standardized, finished drawing. Electrical schematics, block diagrams, and chemical structure diagrams would be likely candidates as input material for such a system. Processing equipment can also be envisaged that accepts a series of functional statements and then generates block diagrams to represent such things as organization structures, communication networks, and block diagrams for electrical and electromechanical equipment.

The writing functions will see increasing automation of the abstracting and indexing operations. This will include the compilation of bibliographies, the composition of title and abstract journals, and other lists and directories. Automation techniques will be used to prepare indexes for manuscripts prior to publication. And in addition, concordances — which have been used to date primarily by linguists, philosophers, and theologians — will start being used in abbreviated form for such practical purposes as guides to textbooks, instruction and procedures manuals, tax guides, and legal literature.

There is a very real possibility of initiating some mechanization of the editing function. It is possible to perform many copy-editing functions by a table look-up operation (that is, standard forms for abbreviations and journal citations, correct spelling, approved terminology). Consequently, some of these functions could be mechanized. It should also soon be possible to do some editing (for form, not content) with data processing equipment in much the same manner as that employed with machine translation, using rules of grammar and word dictionaries. The automatic preparation of routing or distribution lists may be achieved by the maintenance of "interest profiles" of a population of readers. In addition, text material may be reviewed and analyzed to construct basic logic diagrams in a semiautomatic manner for application to such things as legal literature and procedures manuals.

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THE LIBRARY OF TOMORROW

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To cope with the tremendously increasing output of technical papers, libraries are turning to use of machines to assume such functions as cataloging, indexing, abstracting, cross-referencing, translating. New techniques in microminiaturization will provide more efficient storage capacity and information retrieval. One role of the technical writer will be to adapt the input of material for machine scanning. The library of tomorrow is envisioned as part of a global network of communication centers linked by transmission hookups.

INTRODUCTION

Technical libraries in governmental agencies and industrial companies will be the first to apply, extensively, advanced technological developments in library techniques because:

1. These libraries serve highly competitive political and economic markets where the need for immediate information is imperative.
2. Existing library techniques have proved inadequate to meet the burden of providing information for the rapid decisions demanded by these markets.
3. These information consumers can and will pay for the experimentation to develop solutions to their problem.

When the solutions are economically feasible, university and college libraries, and lastly public libraries, will follow the successful lead of these special libraries.

THE PROBLEM

Governmental and industrial personnel are facing a crisis. They are unable to keep up with the quantity of published reports and journal articles now being produced.

> . . . Every 24 hours enough technical papers are turned out around the globe to fill seven sets of the 24-volume *Encyclopedia Britannica*. And the output is rising every year. This year's crop: some 60 million pages or the equivalent of about 465 man-years of steady round-the-clock reading. Hidden away in this glut of literature are thousands of ideas for new products and for cost-saving processes of all sorts. . . . Company after company has found itself duplicating research work that others already have done and fully chronicled.

Thus the *Wall Street Journal* summed up the situation after the heading "Fishing for Facts," on December 20, 1960.

In our own first-hand experience, we have recently seen exactly how the output is accelerating in one kind of publication on one specific subject-physics. In compiling *Dissertations in Physics*, a bibliography of doctoral dissertations from 1861 through 1959, to be published by Stanford University Press next month (May 1961), we found that 5,000 of the 8,419 titles produced in the 98 years appeared since 1950.

Here is the dilemma which confronts the technical librarian: (I shall use librarian in the generic sense, to include documentalists, information specialists, etc.). In an industrial library, for instance, he is responsible for finding information for management on call. He must investigate new methods of surviving this maelstrom. In order to do this, he must evaluate the functions and techniques of existing libraries. There are four fundamental functions essential in any technical library. To render effective service, any library must:

1. Acquire a basic collection which will anticipate the demands of the user so that there is little delay when information is needed.
2. Index the material in depth so that the analysis will pinpoint the contents to be identified by someone searching for the information.
3. Store the material physically, so that it can be immediately accessible.
4. Cross-question the requester to determine his wants in terms used in the systems organization of the library.

These are the basic processes underlying information dissemination. They are, and will continue to be, requisite in any technical information center.

PROSPECTS FOR THE NEAR FUTURE

A. Scope

The library of the immediate tomorrow will be similar in concept to the library of today, but its scope will be broadened to meet the changing demands of the user. The same basic functions must be performed, but more quickly and systematically, for speed and selectivity are new dimensions in the urgency of today's information needs.

B. The Role of Machines

The impact of the new publication rate of scientific literature has revealed the weaknesses in the techniques of the library of today. The growing complexity of the problem has caused management and librarians to seek assistance from electronic devices and digital computers. They have recognized the value of machines in reducing the repetitive routines in libraries, and they have extended their thinking to accept the possibility of relief in other acutely bogged-down, time-consuming areas. They have begun to hope that machines can:

1. Take over the cataloging of information.
2. Take over the storage problem.
3. Interpret the request of the user so that information to meet specific needs may be searched and retrieved.
4. Anticipate the information needs of a scientist by automatically selecting for him information relevant to his specific interests.
5. Answer several questions at one time.
6. Print a bibliography specifying library location of pertinent documents to enable the requester to go to the source to find his answers, or, alternatively,
7. Answer the user directly with the document.
8. Pursue a search as a reference librarian does, and, if the question is not answered in the library, follow through on an interlibrary loan sent automatically over transmission lines to a regional catalog.

C. Machine Storage Media

To make direct application to existing machines, librarians must use different media for recording information from the conventional 3 x 5 library card catalog. Input and recording methods and media vary with the requirements of the machines in which they are used. They range from the simple punched card to a microphotography technique which allows the storage of 10,000 pages on a glass disk approximately one square foot in area. Between these two extremes exist such media as magnetic cards, magnetic disks, magnetic tape, punched paper tape, microfilm in aperture cards, microfilm on reels, microprints, and micro-opaques.

Techniques suggested by these terms have begun to resolve the problem of storage and speed of handling of information. However, the main problem is the meticulous descriptive indexing of incoming publications on a real-time basis. The theory and philosophy of indexing has not been defined. In this area technical writers and librarians should give every support through their knowledge and skills towards the engineering of solutions.

D. Indexing Schemes

Meanwhile, more than 500 commercial abstracting services have developed as publication of at least 55,000 scientific journals has created a pressing need for quick scanning. *Current Contents*, for example, published by the Institute for Scientific Information, lists each week the tables-of-contents of 501 journals dealing with space and physical sciences. This service brings to the scientist titles of more than 100,000 journal articles a year; it brings new information to his attention more quickly than would otherwise be possible; and it provides more complete coverage of his field, since no library is able to incorporate all periodicals in its holdings.

This scanning approach has led to the rudimentary content-indexing of titles by machines; these permutation indexes are rotated and listed on each key word. Two examples of this in the field of chemistry are *Chemical Titles* and *Chemical Patents*, key-word-in-context indexes published by the Chemical Abstracts Service. These are not intended to be a substitute for *Chemical Abstracts*, but the regular abstracts may be from six months to a year late when they appear, so these indexes were developed to provide clues to current literature within three weeks after publication.

Journal articles alone are certainly numerous enough to recommend machine-indexing of scientific publications; but the problem is further complicated by the publication, in one year, of 100,000 government and company reports, and 6,000 scientific and technical books. The need for access to all the new information in these publications has led to further investigation of depth indexing designed to be compatible with complete machine search and retrieval.

Since technology's demands for more information have caused the dilemma in libraries, management and librarians look to advances in technology to provide an answer to the present situation. As E. M. Hugh-Jones has said, ". . . advances in technology are always ultimately beneficial, but the immediate impact is seldom painless." In spite of the trials of today, we have good reason to expect that present experiments will bring innovations to cope with the problems of the communication of information.

OUTSIDE SUPPORT

The importance of this vital problem spurred the establishment of the Council of Library Resources which, in 1956, was endowed by the Ford Foundation with five million dollars to conduct studies to investigate every phase of library work. This year this Council has received an additional three million dollars to establish a laboratory which is essentially for the library of the future. The National Science Foundation, charged by Congress with the mission of developing new and improved methods for making scientific information available, is initiating basic research and surveys to resolve the problems. There are also countless private enterprises in this country and Europe conducted by universities, industrial companies, and individuals in different aspects of information retrieval. A comprehensive review of studies in progress is compiled by the Office of Science Information Service of the National Science Foundation, entitled *Current Research and Development in Scientific Documentation.* The latest issue, No. 7, was published in November 1960.

The studies in progress are at various stages of development; some are proving successful, others have met pitfalls, but in total, enough significant achievements have been made to encourage the expectation that the library of the late 1960's, of tomorrow, will be fully automated.

TECHNICAL WRITER'S ROLE

In the meantime, there is a real role for the technical writer, editor, and publisher. Your responsibility will be the "input" into the machine, just as the technical librarian's responsibility will be the "output," and between us will be a mechanism capable of making at least 10,000 logical decisions per second. However, until this machine becomes more educable, the initial constraints placed upon editors, writers, and publishers might be standardization and consistency. Reasonable adherence to these ideas will speed handling in the machine. Machine scanning will require:

1. Consistency in format.
   a. To assist machine recognition, for example, index terms in the text might be printed in capitals or in bold face.
   b. To facilitate machine entry, author, title, date, abstract, and bibliography might have uniform arrangement.

2. Normalizing writing style.
   a. To facilitate machine scanning, sentence structure might be standardized.
   b. To delineate facts precisely, rather than descriptively, writing may be expected to become more abbreviated.
   c. To serve a double purpose, it is conceivable that papers may be written in two forms: in semi-technical language to inform the layman, and in machine-processable language to inform a scientist.
   d. To prevent repetitious entries and unnecessary proliferation of material in publishing, the editor or publisher may assume complete responsibility for screening information.
   e. And finally, with the advent of voice-recognition machines, it is foreseeable that the technical writer will become the technical talker.

To meet the urgent need for instant information, such constraints will assist the machine to speed the handling of material. But it must be insisted that a machine is a tool in a system: it is not the system itself.

THE LIBRARY OF TOMORROW

A. Scope

Concepts of a library have had an evolutionary change from archival storehouses to dynamic technical information centers, and these will expand to pulsating communication centers where transmission hook-ups with regional, national, and international centers will make current information as immediately available as information of the past. It is foreseeable that these regional centers may be specialized subject information depositories. By the late 1970's we can expect technology to be so far advanced that a vast transmission network will make into a reality the possibility of calling upon total global resources to locate information: remote input and output stations may be in direct, automatic communication with central information storage and retrieval centers.

B. Functions and Services

We shall expect this communication center of tomorrow to have surmounted the present hurdles in library service — backlogs in cataloging, insufficient redundancy in catalogs, lack of shelf space, inadequate answers to reference queries, and lack of literature surveillance. The four basic functions requisite in any library will be incorporated into a wider spectrum of services.

The first function, acquisitions, will have changed its character — a character largely under the control of editors, writers, and publishers. Indexing and classifying will be done automatically. Machines will standardize in common language the cataloging for all libraries in a network. Texts entering the system will be completely machine read and analyzed for content on the basis of word frequency, phrase frequency, and word relationships. Abstracts will be generated automatically. Automatic recognition of synonyms will accomplish machine cross-referencing.

New techniques in microminiaturization will provide more efficient storage capacity and rapid access to stored information.

The reference function will be expanded to involve an heuristic querying system between the user and the machine. This will supersede the librarian's interrogation at a reference desk. The user in the future will interrogate the computer library and will be guided by the machine responses until he defines, in terms the machine recognizes, the information he needs. This feedback feature will increase efficiency in searching. The end product could be a bibliography of titles and abstracts, or could be copies of selected documents.

New services, hitherto only wished for in the library world, will be performed on a regular basis. For example, selective dissemination of information will make a scientist aware of the current information he needs to learn by automatically matching his personal and project interest profile with that of incoming information. This should make an employee better informed and, therefore, more valuable to his company.

Browsing, indispensable to scientists and engineers for serendipity — that fortunate coincidence when a falling apple strikes the right head — will be facilitated by mechanical devices such as a "Browsing Machine" with an associative memory and an ability to help the user scan rapidly.

If the user wants a translation of a document, he will be able to have the book reproduced in the language of his choice by mechanical translation. If he does not wish a complete translation, he may specify an abstract, or a set of index terms.

The library of the tomorrow will have eliminated the overdue notice. A permanent copy of any document will be available at a small cost to the reader.

An indirect function of the library of today is teaching: but in the tomorrow, this will be a direct function of the communication center. It is conceivable that self-instruction machines will be available. Teaching machines will instruct, and then question the student to assure that he has understood the lesson. This reinforcement process is a further use of the feedback system of questioning and answering.

It will be possible for the computer in the library of tomorrow to pursue a search to a successful conclusion even if the information wanted is not available in a company library, for instance. Requests will be automatically transmitted to the specialized regional centers or to national depositories until the information is found. At this stage, interlibrary loans will have become a right, and not merely a privilege and a courtesy as they are today.

In the main communication center the machines will be able to accept queries from multiple terminals simultaneously, and search and answer several questions at once.

It is foreseeable that there will have to be a radical change in the physical facility of the library when it becomes a communication center. Actually, I envision a building comparable to the controversial Guggenheim Museum, with the computers and programmers occupying the spacious central section, and a series of cubicles containing closed-circuit television sets along the ramp.

The scientist or engineer in a laboratory will not have to leave his desk to seek information. He will have there a video terminal with closed-circuit television, through which he can query the central file by voice input or by handwritten input. Responses will appear on the visual display panel, and if the requester is not satisfied, he can re-interrogate the machine until he receives the information needed. The same method will serve the library user in the study cubicles mentioned above.

The type of librarian in the communication center will be different from the librarian of today. His training will be machine oriented. Schools of Library Science are already incorporating new courses in mathematics and machines to prepare librarians for the new age. These people will be highly trained specialists, whose chief qualification will be to know their machines — indeed a different breed from the librarian of today, whose main interest is to know people and books, and to give service.

IN CONCLUSION

If you find it difficult to accept this new concept of an automated library, think back to the first airplanes. They were looked upon with awe, when they flew only short distances. This was a miracle, but few wanted to use them, and few suspected they would become the efficient time-saving means of jet-age transportation they are today.

The potential library of tomorrow is a library filled with people and not with books, for the book in the technical center will not remain in its traditional form. But there are progressive steps which must be taken, and many pitfalls to be avoided, before we reach the ultimate in library automation. It is during these intervening years that you and we must play a vigilant role in the advancing stages of this process. Technology must not find us unprepared to load the machines or retrieve from them. It is by surmounting the difficulties in experiments that solutions become realities. If you and we do not do a good job of collecting and organizing information, the scientists who need this information will not be able to find it.

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"JOHN HENRY" AND THE TECHNICAL EDITOR

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Machines are capable of taking over the routine, repetitious tasks of editing — those tasks which depend on memory. In particular they are being used extensively for language translation. But for the creative tasks, such as the organizing of written material, the human editor continues to be indispensible.

> John Henry told his Captain,
> "Well, a man ain't nothin' but a man,
> And before I let that steam drill beat me down,
> I'll die with a hammer in my hand,
> I'll die with a hammer in my hand."

So goes the ballad of one man's reaction to automation. He fought it to the death. Unfortunately, this reaction is not typical, even among those with more sophistication than John Henry was capable of. It is, of course, a completely unsophisticated and emotional reaction to what is interpreted as a threat to one's livelihood.

Among those ardently *for* automation and those ardently *against* it, there is great unity — both extremes believe automation capable of any- and everything. But both, I think, are equally far from the realities of what will come. And what will come? I think I should make it clear at the outset that I believe automatic technical editing will come. I believe that, given the interest in it, automation can be unequivocally demonstrated in the next two or three years, and be quite sophisticated by 1970. I should also make it clear that I am incompetent to discuss machine organization — I am a reformed skeptic addressing himself to unreformed skeptics. My intention is not to persuade, but to create an awareness of — if not an interest in — certain work that has been, and is at this moment, going on that may have definite implications for the technical editor.

I make my living from technical editing, but I am not now preparing against the day when I will be replaced by a computer whose specialty is translating English into English — which is one way of expressing what editors do. The problem is that under present circumstances our average editorial day is spent in all too little of translating English into English and much too much in using that part of the mind that would in computer terms be called memory — the part that tells us whether "utilization" has one "el" or two, and that the British use "s" instead of "z." There is nothing creative for me in that. It is a feat of memory, and when I have struck out an extra "el" and closed it up, I feel every bit as clever as Charlie Chaplin's character in "Modern Times" when he gave another dexterous twist with both wrenches! So, of course, I would not personally resent a computer taking over this sort of activity for me.

What is it, then, that these computers — these editing machines — will do? The computer industry, generally speaking, is interested in solving classes of problems. One of the nostrums of their business is that in any area of human activity, 80 per cent is redundant and repetitive, while 20 per cent is unusual and requires an unusual or creative solution. Without arguing the validity of the exact percentages given, most of us would agree that there is a larger percentage of our activities day-to-day that could be characterized as being routine or subject to being routinized, while there is a smaller percentage of occurrences that need individually conceived solutions. Properly then, the larger parts of human activity have been the targets for automation, both as being the most desirable in relieving human drudgery, and as being the most attractive economically. Several good examples of this were cited by Mr. Bourne in his paper. But, what I take to be developments leading to automated editing are not coming directly from commercial enterprise, as such, so much as from governmental contracts aimed at mass — which is to say automated — translation of scientific and technological developments reported in languages other than English.

Work in machine translation has been going on for some considerable number of years now, and in particular earnest since 1955. Starting with existing machines — general-purpose computers — the attempts have been numerous to devise what computer people call an algorithm (a routine or procedure for solving problems) for language translation. But the effort cannot be judged alone by the direct assaults on translation. Just as automated editing depends on the development of automated translation, so translational algorithms or special-purpose machines depend in turn upon ostensibly unrelated advances in the disciplines of combinatorial and topological mathematics, as well as in the general art of programming and the sophistication of bult-in computer commands.

A cursory look into the literature rewardingly demonstrates the advances of the past dozen years in implementing with techniques and hardware the theories of, among others, Claude Shannon, Norbert Weiner, and John Von Neumann. Interestingly enough, the Russians have adopted the word *cybernetics* from Weiner's title, and, acknowledging its source, have conferred upon cybernetics the status of a scientific discipline. A most interesting group of papers from Russia dated mid-1957 has been translated and published under the general title, *Problems of Cybernetics*, by the Pergamon Press, 1960. The general editor, A. A. Lyapunov, in an introductory article deftly makes this statement of the problem:

> The basic problem around which cybernetics has been formed is the question of the relationship between the behavior of computing machines and thought. . . . Computers and thought represent two control systems with very broad and flexible possibilities, in a way, of diametrically opposing types; the computer is a control system acting in a strictly formal manner according to a pre-assigned algorithm, while thought is a control system the functioning of which is not at all formalized. Thus, the basic problem of the interrelationship between the potentialities of the computer and of thought is the question of the relationship of two types of control systems, constituting opposites from the point of view of the degree of formalization and, at the same time, universal in their possibilities.[1]

Other titles in this volume show a direct interest and some advanced work in the specific area of language translation by computer: "Questions Involved in Distinguishing Homonyms When Translating from English into Russian Using a Computer," by T. N. Moloshnaya; "Machine Translation from Hungarian to Russian," by I. A. Mel'chuk;[2] and "A Method of Determining Grammatical Concepts by Group Theory," by O. S. Kulagina, who says, "Work on the creation of an algorithm for mechanical translation from one language into another has shown that existing grammars are not always adequate or convenient for the construction of such algorithms."[3] This last paper is highly mathematical and contains a generalization that out of its context is amusingly bold: "Let a given group of elements, Chi, be the words of the French language. . . ."[4]

In the United States, we find in *Information and Control* an article entitled "A Program for Correcting Spelling Errors," by Charles R. Blair, who writes,

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[1]Superscript numbers denote references, which will be found at the end of the paper.

> It is tempting to assume that English spelling is too irrational to be explained to a computer. If we limit ourselves to algorithms, perhaps this is true; yet if we give the machine an extensive vocabulary, it can be programmed to recognize as misspelled any word that is not in this list.[5]

But far and away the most significant news was carried in many journals. I shall quote from the *Journal of the Franklin Institute,* August 1960:

> An electronic translator capable of turning Russian into English at the rate of 35 words a second has been developed under a five-year project at the Air Research and Development Command's Rome Air Development Center, Griffiss AFB, N. Y. . . . the translator has been in use on an experimental basis since June 1959. According to Air Force engineers, the English output is "no literary masterpiece" since translation at this point is on a word-for-word basis. However, the machine gives a very good idea of the general content of a Russian article — even though it ignores many of the grammer rules. By the end of this year a sophisticated word analyzer with logic circuits for sentence structure will be added into the translation complex.
>
> The intelligence laboratory at the Rome Air Development Center is using the research and knowledge of top language scientists in this country and abroad. It has contracts with seven universities and four industrial firms in the automatic language translation program. . . . Another problem — that of transmitting graphic material along with the written word — is now under study . . . by the Syracuse University Department of Graphic Engineering. . . . The "thinking" portion of the translator — the dictionary and word analyzer — is also being improved at IBM Research. A lexical "buffer" has recently been added which stores words coming from the photoscopic dictionary in complete sentences. The "analyzer" will provide corrected grammar.[6]

The *Palo Alto Times* of Jan. 24, 1961, discussing the same machine, wrote:

> . . . To solve grammatical difficulties, pick proper definitions, insert hyphens and apostrophes, use prefixes and suffixes properly, the machine will go back over a sentence 26 times. . . .[7]

The *San Francisco Chronicle* of the same date said:

> New refinements will soon enable the Mark II to do far more, . . . it not only will look up the words and examine each sentence for context, but will perform a sort of context-review. . .to refine the translation of each sentence and smooth out the final lanugage.[8]

From these comments, I gather that this machine is making 26 passes over rough English to make smooth English; and this begins to sound something like what I do for a living! But on more mature consideration, I have to admit that it's only what I would like to do for a living. Really most of my time goes to spotting illustrations, paginating, making contents and lists of illustrations, proofing, and the like.

What then ought to, and probably will, remain in the province of the human editor? One great virtue of human editors and one that ought to remain always in their province is the ability to organize a writing — to order what is already present. One of our most frequent editorial acts is to transpose phrases and clauses in a sentence and sentences within paragraphs. The order in which a thing has been done or thought is not usually the best descriptive order. People from the disciplines of science and engineering — doubtless because of their rich backgrounds in lab courses — fall most readily into an organization I call recipe-order. *Science,* in editorializing this point, gave these two versions of a simple experiment:

> *First Version:* Ordinarily, determining whether an egg is cooked or raw without breaking the shell poses no special problem. But suppose that several hard-boiled eggs — now cooled — are inadvertently mixed with several raw eggs. How then would you tell them apart? The following method requires no special equipment, only the application of a well-known physical principle. Place each egg on its side and attempt to spin it. If it spins easily, it is cooked; if not, it is raw. Raw eggs do not spin readily because the

rotational energy is dissipated in the egg's interior, as dictated by the hydrodynamics of viscous fluids. To confirm the method, break the eggs.

Second Version: Twelve white eggs were purchased at a supermarket. The eggs were divided into two groups of equal number. The eggs in the first group were boiled seven minutes and allowed to cool; the eggs in the second group were kept as controls. The eggs were mixed. Each egg was placed on its side, and an attempt was made to spin it, after which the egg was broken. It was easy to spin those eggs that subsequently were found to be cooked, but difficult to spin those eggs that proved to be raw. Etc., etc.[9]

It is highly unlikely that a computer will be made that would be capable of making either of the above versions from the other — economically — whereas it is no trick at all for a good writer-editor. Moreover, the human editor is gratified by such a performance because he is presented with a challenge that requires a creative solution. Memory is certainly required, but it is the kind of memory which is most primitive in current computer developments and therefore appears relatively to be the most highly developed in the human organization of memory. We have in this set of circumstances the probabilities for human success optimized in a potential competition with computers, whereas computer programs for correcting tense, number, spelling, punctuation, and format control are so highly advanced even now as to discourage human specialization in these areas.

So editors need not despair. There will be a continuing need for editors, and this need will be for that part of our present activties that is most rewarding. The requirements for the editor's technical background will be perhaps more stringent, but most stringent of all will be the requirement for an alert, inquistive, intuitive mind — a mind well disciplined, capable of sensitive and sympathetic reading and of composing closely reasoned arguments, exposition, and narrative.

Even with the matured development of editing machines, there is an inhibiting factor to the widespread incursion of automated editing in the latent inertia of many small editing shops scattered throughout the nation generally and within large companies. There is perhaps an analogy in the oil companies' credit-card accounting operations whose gradual centralization from small district offices to regional offices was accomplished as machine accounting and billing methods progressed. But, as I say, our groups are now small and relatively decentralized so that individual budgets look fairly small, and are not now lumped on a companywide or countrywide basis to form juicy targets for automational economies. We can take additional comfort in status-quoism, which is always formidable.

As a final word, I should like to quote an unlikely source, which could be considered portentious for the spellers and orthographers among technical editors. This rather nostalgic and vaguely plaintive passage is from *Speed and Fun with Figures*, published in 1939:

> Owing to the extensive introduction of adding machines, there is not the same demand for men who are rapid adders that there once was.[10]

* * * *

John Henry told his Captain,
"Well, a man ain't nothin' but a man,
And before I let that steam drill beat me down,
I'll die with a hammer in my hand,
I'll die with a hammer in my hand."

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PANEL 5 — MILITARY SALES PROPOSALS

WHEN AND HOW TO PROPOSE

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The basic ground rules for submitting proposals are described in general terms. Emphasis is placed on long-range marketing plans, short-range intelligence, and effective follow-up.

The subject, When and How to Propose, contains, in my opinion, an important key to the successful technical enterprise. What I'm going to present briefly are certain general ground rules that I feel should be followed.

From a new business point of view, the attendees of this meeting can be roughly divided into two categories: (1) those who receive the greatest share of their work directly from a government agency, such as Air Force, Navy, and NASA, and (2) those who are traditionally subcontractors to primes such as Boeing, Convair, and Lockheed.

The rules of when and how to propose vary in some ways, depending upon who your customer is. One distinction is that if you are trying to propose directly to the Government, a contract has generally not been let, while a prime may already be in possession of a contract and is searching for a reliable vendor. For the purpose of this talk, I am assuming the customer is the Government.

Certain proposed marketing techniques are universally important and are seldom organized or effectively implemented. These are:

1. Long-range marketing strategy.
2. Effective short-range G-2 to discover what the requirements are, when they should be proposed, and in what manner (how) they should be proposed.
3. Effective follow-up on proposals.

Long-range marketing involves knowing the needs of your customer or agency, prior even to their awareness. Marketing should follow the development of a requirement for a DOD source (Pentagon Planning Office) through the various Army-Navy-Air Force organizations and through agency procurement. This action will allow for early development and availability of the needed skills, personnel, and versatility of organization — particularly in this era of quick reaction capability. Each line organization can thus be guided into developing in accordance with changing needs.

More short-range in nature is the necessity for reliable G-2, to know *months* in advance the nature of a particular requirement. Extreme emphasis should be placed upon:

1. What are the specific requirements of the job?
2. How much money has the customer alloted for this job?
3. What is the delivery span?
4. How does the customer feel about your past performance?

If you have this information, or your marketing department can give you an educated guess, start work on the proposal at once — before you receive your request for quote. This is extremely important because response times to RFQ's in many areas are getting shorter and shorter and coordination problems, in large organizations particularly, are becoming extremely time-consuming.

Generally, it is a good idea to select a project manager for the proposal — one man who has the responsibility to get the job out on time — and one marketing man who keeps in contact with the customer for receiving RFQ changes, keeping track of the paperwork, and posing questions to his contact in procurement.

Your proposal should always be responsive. Keep your costs as competitive as possible and certainly within the funds allotted to the buying organization. Be technically responsive to the requirement; if you disagree with the customer approach, suggest an alternative plan — but only as a supplement to your response. Your proposal should stay in the parameters requested. It should be brief, but include a clear plan for action with a minimum of personnel and equipment — only those necessary to accomplish the mission.

Your delivery schedule should correspond to the project — even offer to beat the start and end dates. Don't put too much "fat" in your schedule — it shows a lack of confidence.

I stated previously that marketing should determine how the customer feels about your past performance. If there have been previous disagreements, find the cause and meet with your customer. Most of these disagreements probably arose from communication problems. You may be able to change their thinking if you have a legitimate side to your part of the disagreement that has never been brought to light.

Many RFQ's have sketchy or incomplete material. You must know what the customer wants, which is sometimes different from what he requests. Awards are based on effective G-2. This is a subject one has to work on to build a successful marketing approach.

When to propose?

1. When you have a solicited requirement, meet the response dates — extensions are becoming very difficult to get.
2. On an unsolicited proposal, the techniques are varied but tie into the G-2 system.

If you have accurate information on a requirement, and you have developed the skills needed to meet the requirement (and you feel you can get the business on a sole-source basis), you are at the point where you must either propose or wait for an RFQ.

The points to consider against proposing are (1) you may be subjecting your techniques and costs to competitors, and (2) the chances of going through a "brain-picking" exercise increase. However, I do not want to appear cynical towards unsolicited proposals; these proposals perform a great service to the armed forces and the defense effort. They encourage new ideas and tend to get the mission accomplished within the shortest lead time. When ought you to propose on an unsolicited basis? Obviously, the timing is based on available G-2 (and how much you trust it) and on a management decision as to whether this proposal serves the best interests of your company and the customer.

I mentioned effective follow-up of proposals: this must be accomplished with great skills to minimize annoyance. Since proposal evaluation and award may involve as many as 25 individuals' concurrence, it behooves your marketing department to try to be available to answer the many questions that will arise and to attempt to get expedited action through the approval cycle. This is a touchy matter, since no one likes interference with procedures which have usually been based upon past, and sometimes sad, experience. But, as most of you know, expediting coverage on time can mean the difference between making or not making important delivery schedules.

To summarize:

1. Have effective long-range planning.
2. Develop accurate short-range G-2 that you can depend on.
3. Follow up on your proposals.

All that I have said has occurred to you, I am sure. The problem is, most of us do not work at it.

HOW THE MILITARY EVALUATES SALES PROPOSALS

by Harlan A. Robinson
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The methods by which the various Government agencies evaluate proposals are described, with emphasis on the newer, numerical techniques. Suggestions are made for writing proposals so as to take into account the problems of the evaluators.

During the past two years the military has become increasingly sophisticated in its methods of evaluating sales proposals. There is nothing accidental in this development. It has stemmed from increasing pressures exerted by Congressional investigating committees and the General Accounting Office: An irate senator from Florida may at any time demand an investigation into the circumstances surrounding a contract award to a California manufacturer. The GAO may at any time put our military customer on the pan for having selected a prime contractor who, in retrospect, failed to exercise proper cost controls over his subcontractors. And so on.

Unfortunately, these investigations have most frequently taken place months or even years after the contract award. With recollection fuzzy, and in the absence of documentation supporting the award, the military has often been unable to provide satisfactory justification and, therefore, has emerged from many a Congressional fracas with its image considerably tarnished. And so our military customer has developed a hypersensitivity in this area. Consciousness of image, gentlemen, is not confined to Madison Avenue: It is rampant within the Pentagon as well.

In this defensive atmosphere, then, the military set out to evolve new techniques by which to evaluate proposals — techniques which would enable them to justify awards *quantitatively* as well as *qualitatively*.

Of all the various service agencies, the Air Research and Development Command of USAF pioneered the effort. And since it started earlier and has worked longer in this venture than any other agency, ARDC is responsible for the most comprehensive and sophisticated system developed to date for the rating of proposals. The system is arithmetic. It works as follows:

The standard for evaluation is set by establishing factors which will serve as the basic evaluation criteria. As a general rule these factors do not exceed eight in number:

- Technical approach
- Technical competence
- Project direction and management
- Reliability and quality
- Field service and support
- Manufacturing and procurement competence
- Price
- Delivery

The applicable factors that will be considered in the evaluation are then assigned *weights* in accordance with their relative importance to the ARDC source selection board. The factors to be considered, and the weights assigned to each, are recorded an official ARDC evaluation worksheets in advance of the dissemination of requests for proposal. The worksheets are then retained for subsequent use in evaluating bids or proposals received as the result of ensuing procurement action.

Obviously, the factors to be evaluated and their relative weights will vary considerably from proposal to proposal depending upon the *type of item* being procured and the *category of procurement* involved. For example, a small study proposal in a new field of technology, where the end product will be a written report on feasibility, will be evaluated with heavy emphasis on the technical approach and little or no significance attached to manufacturing competence or field service and support capabilities. A large follow-on contract for production hardware, on the other hand, will emphasize manufacturing competence, price, delivery, reliability, and field service and support. Every proposal is evaluated in accordance with standards tailor-made for *it*.

And so, in view of the limited time available for the preparation of proposals, it is incumbent upon the prospective bidder to shoot his best shot in attempting to second-guess the standards which have been preset by the source selection board. The arithmetic evaluation system developed by ARDC has now become standard throughout other commands of USAF, such as AMC, the C and N Labs, C^2 D^2 and so on. At the other end of the customer spectrum, the Navy has been slower to adopt mathematical techniques for rating proposals. They have stayed pretty much with qualitative, rather than quantitative rating scales. However, since BuAer and BuOrd were merged into BuWeps, there have been strong indications that the Navy is veering toward the arithmetic approach in proposal evaluation. This trend is presently encouraged by BuWeps recent success in the numbers racket — PERT.

The Army's evaluation procedures are intermediate between those of the Air Force and the Navy. The Army's evaluation process is highly decentralized. Within Army Ordnance, for example, each arsenal handles its own procurement and evaluation of proposals. Arithmetic ratings are not employed by the arsenals. Within the Signal Corps, proposal evaluations are made by the local Signal Corps agencies such as Fort Monmouth. Some employ arithmetic rating systems, some do not.

The AEC, ARPA, and FAA all use mathematical tools in arriving at comparative ratings for proposals. NASA is tending in this direction.

DOD apparently has no interest in bringing about standardization of evaluation techniques among the various branches of the service. The Pentagon considers evaluation procedures to be very definitely the prerogative of the individual military agency so long as they do not conflict with ASPR.

Now, with your leave, I would like to take you backstage, as it were, and give you a glimpse of what actually goes on in the customer's camp on D-day, the day proposals are due from all bidders. The locale is Dayton, Ohio. The time 8:00 o'clock on a snowy morning at Wright-Patterson Air Force Base. In a dingy room housing numerous uncomfortable wooden chairs, desks, and tables, a group of 40 men, some in uniform, some in civvies, mill about. Humid heat pours from the clattering steam pipes. This room is known as "the pit," and the inmates are members of an Air Force evaluation board. Suddenly the double doors open and a fork lift lumbers into the room. It is piled high with volumes — proposals submitted by 15 contractors who are bidding for the XYZ Project. The evaluators roll up their sleeves and go to work. They will work in this hectic and uncomfortable environment up to 18 hours a day until their job is done.

Lest you perhaps think that I am over-dramatizing the scene, let me cite an example of recent experience at Hughes. We, along with a number of other contractors were invited to submit a proposal for an orbiting astronomical observatory. I was horrified to discover that our proposal would run to seven volumes. It turned out subsequently that the Hughes proposal was the *shortest* of 17 proposals submitted. The longest comprised 24 volumes and was delivered in wooden packing cases to the pit.

What is the significance of all this for *you*, the technical writer?

First of all, your output is going to be reviewed in an atmosphere that is hardly conducive to the enjoyment of rich, beautiful prose. The evaluators are not in the pit for entertainment. They are there strictly for business and they are working against a tight time deadline. They are *not* going to be impressed by fancy words, elaborate artwork, and gold-embossed covers. They are interested only in the meat and potatoes, and if they can't get at them without wading through the *hors d'oeuvres*, soup, and salad they are going to view your proposal with a jaundiced eye right from the start.

Second, fatigue may have substantially lowered the *comprehension level* of the evaluators by the time they get around to reviewing *your* proposal. So, you must organize and present your proposal material in a manner which will make the evaluator's job *easy*, rather than tough. Follow, wherever possible, the same outline that is contained in the request for proposal. This will make it easy for the evaluator to follow *you*.

Be sure that your proposal is *responsive*, that it complies with each and every stipulation of the RFP. The evaluators are only too eager to nail you as noncompliant, for in so doing they can quickly cut down to workable size the mountain of paper that came in on the fork lift.

Remember, too, that you are not writing for an exclusively technical audience. The evaluation team will be composed not only of engineers, but of people who are specialists in the areas of logistics, maintenance, operations, finance, and so on. You must sell all these specialists if you are to be assured of a winning proposal.

In conclusion, I should like to leave you ten commandments which have been paraphrased from a booklet published by Minneapolis-Honeywell entitled "Why Not Just Tell Them?"

"Thou shalt know what thou art writing about.

"Thou shalt think before thou write.

"Thou shalt know thy readers and write for them.

"Thou shalt NOT substitute adjectives for facts.

"Thou shalt be accurate, exact, and thorough.

"Thou shalt NOT show off thy technical vocabulary.

"Thou shalt NOT leave any unanswered questions in the reader's mind.

"Thou shalt edit thine own copy as mercilessly as if it were somebody else's.

"Thou shalt NOT turn easayist. Thou shalt leave that to Henry James and Max Beerbohm."

PANEL 6 — GOALS FOR THE TECHNICAL REPORT

WHAT MANAGEMENT WANTS

by James W. Souther
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To develop two report-writing guides, What to Report *and* Managing Report Writing, *a survey is conducted among managers. Lists of questions phrased by Opinion Research Corporation define the areas of the technical problem, experiments and tests, materials and processes, and of field trials. Also considered are market factors and organizational problems as well as the particular scientific level at which the report should be written.*

My remarks this morning will be directed first to a brief description of the research project that was undertaken recently at Westinghouse to find out "what management looks for in engineering reports," and second, to the results of the research project.

REPORT-WRITING RESEARCH PROJECT

First, I should like to describe briefly the research project itself; its concept, organization, and method.

Concept

A great many persons are just beginning to realize that the reason engineering reports do not convey information efficiently to management is that the author does not understand precisely what management wants to know. As a result, the management reader has to winnow the information he wants and needs from verbiage or go back to the author with a list of specific questions, either one of which is wasteful of time.

Recognizing this problem for what it is, insoluble without information on the kind of reports management wants, Westinghouse decided to get this information through personal interviews with persons in supervisory and management positions. Our objective was answers that would tell us precisely what management looks for in engineering reports. Our goal was a report-writing guide.

Organization

Two Westinghouse departments were assigned the responsibility for the project: the Educational Department and the Technical Information Department; the former because of its relationship with college and university professors, and the latter because of its relationship with the presentation of technical information. Both felt that the need to obtain unbiased and objective results outweighed all other considerations. Therefore, I was employed to conduct the research project.

A second person outside the employ of Westinghouse was brought into the project: Professor Erwin R. Steinberg, Head of the Department of General Studies of the Carnegie Institute of Technology in Pittsburgh, who serves as a consultant in oral and written communications to the Educational Department. His principal duties in this capacity are to acquaint engineering graduates who have joined Westinghouse with the extent and nature of the communications problem of practicing engineers.

Method

The first thing we did was to define the scope and extent of the report-writing research project. The study was limited to engineering reports because we wanted to dig as deeply as possible into management's informational needs, and we agreed this could not be done efficiently and satisfactorily unless the investigation was limited to one kind of report.

The second thing we did was to list the things we felt we needed to know about management's informational requirements. This list was then sent to The Opinion Research Corporation in Princeton, New Jersey, for phrasing as interview questions. Following return of the questions, a number of interviews were made to evaluate them.

As soon as the interview questions had been evaluated, interviews were arranged with 70 members of management that included all levels of supervision from vice president-engineering to section manager. The members of management interviewed represented a valid cross section, as extreme care was exercised in their selection to be sure that both staff and line management was included, and that line management represented a wide range of product divisions. The object was to interview as many persons in dissimilar work situations as possible. This we felt would assure wider applicability of the results to the report-writing process.

Each interview began with this question: "What kinds of reports are submitted to you?" This was followed by such questions as:

> What do you look for first in the reports submitted to you?
> What do you want from reports?
> What kinds of information do you need as a basis for your decisions?
> To what depth do you want to follow any one particular idea?
> At what level should the report be written?
> What do you want emphasized in the reports submitted to you?
> What do you think your boss wants in the reports you send him?

Each interview took from one-and-one-half to two hours to complete. I made minimal notes during the interview and then recorded and expanded these at the end of the day while answers were still fresh in my mind. The typed interviews were classified and grouped according to supervisory class and level. After the material was studied and evaluated, a summary report was sent to each person interviewed with the request that he comment on the need for and the method of adapting the summary report material into a report-writing guide.

The results of the study were not startling. The extent of agreement among the people interviewed concerning what they wanted, however, was surprisingly high. Although the project did not provide us with a great deal of new information, it did provide us with a much sharper focus and clearer definition of informational requirements than we heretofore possessed. In many instances, the assumptions we had made in the past were given a realistic basis and we now know a little more clearly where we stand. Through this study, we were able (1) to identify the informational needs of management with considerable accuracy and (2), to determine how management uses reports and what its reading habits are.

WHAT MANAGEMENT LOOKS FOR IN ENGINEERING REPORTS

We found that, when a manager reads a report, he looks for pertinent facts and competent opinions that will aid him in decision making. He wants to know right away whether he should read the report, route it, or skip it.

To determine this, he wants fast answers to some or all of the following questions:

> What's the report about and who wrote it?
>
> What does it contribute?
>
> What are the conclusions and recommendations?
>
> What are their importance and significance?
>
> What's the implication to the Company?
>
> What actions are suggested? Short range? Long range?
>
> Why? By whom? When? How?

The manager wants this information in brief, concise, and meaningful terms. He wants it at the beginning of the report and all in one piece. Given this information, he can decide quickly whether he should read the report, route it, or skip it.

The kind of information a manager wants in a report is determined by his management responsibilities, but how he wants this information presented is determined largely by his reading habits. We found through this study that Westinghouse management report reading habits are surprisingly similar. Every manager interviewed said he read the summary or abstract; a bare majority said they read the introduction and background sections as well as the conclusions and recommendations; but only a few managers read the body of the report or the appendix material.

The managers who read the background section, or the conclusions and recommendations, said they did so ". . . to gain a better perspective of the material being reported and to find an answer to the all-important question: What do we do next?" Those who read the body of the report gave as their reason for doing so one of the following reasons:

1. Especially interested in subject;
2. Deeply involved in the project;
3. Urgency of problem requires it; or
4. Skeptical of conclusions drawn.

And those few managers who read the appendix material did so to evaluate further the work being reported. To the report writer, this can mean but one thing: If a report is to convey useful information efficiently, the structure must not ignore the manager's reading habits.

The Frequency of Reading chart, which depicts graphically what I've just said about reading habits, suggests how a report should be structured if it is to be useful to management readers. For example, if a summary is to convey information efficiently, it should contain three kinds of facts:

1. What the report is about;
2. The significance and implications of the work; and
3. The action called for.

To give an intelligent idea of what the report is about, first of all the problem must be defined. Then, the objectives of the project should be set forth. Next, the reasons for doing the work must be given. Following this should come the conclusions and, finally, the recommendations.

The second kind of facts to be included in the report summary can be satisfied with a definitive statement about the significance of the work followed by an interpretive statement of the implications. The third kind of facts must tell who is to do what, when he is to do it, and how he is to do it.

Such summaries are informative and useful. They meet the informational needs of most management readers when placed at the beginning of the report. Summaries should be structured to focus on the significant work, to give perspective, and to present concisely the scope of the report.

Subject Matter Interest

In addition to what facts a manager looks for in a report and how he reads reports, we also learned that he's interested in five broad technological areas:

1. Technical problems,
2. New projects and products,
3. Experiments and tests,
4. Materials and processes, and
5. Field troubles.

As you might imagine, managers want to know a number of things about each of these areas. For example, they want to know these things about the technical problem area:

What is the problem?
How did it arise?
What is the magnitude and importance of it?
What is being done about it? By whom?
Why was this undertaken?
What approaches are being used?
Are these thorough and complete?
What are the suggested solutions?
Which one is best?
Should others be considered?
What needs to be done now?
Who does it?
What are the time factors?

These ten guide questions for this area, when used as intended — to challenge content — will assure the engineer that his report will convey information to management effectively.

Westinghouse managers want to know these things about the new projects and products area:

What is the potential?
What are the risks?
What is the scope of application?

What are the commercial implications?
How stiff is the competition?
How important is this to the Company?
How much more work must be done? Are there any problems?
Are additional manpower, facilities, or equipment required?
What is its relative importance to other projects or products?
What is the life of the project or product line?
How will this affect the Westinghouse technical positions?
Are any priorities required?
What is the proposed schedule?
What is the target date?

As with the technical problem area, the guide questions will ensure the kind of report management expects from engineers.

In the other three areas: experiments and tests, materials and processes, and field troubles, these are the things management wants to know about each. First, experiments and tests:

What was tested or investigated?
Why was this done?
How was it done?
What did the test show?
Are there better ways to conduct tests?
What conclusions do you draw from the test?
What do you recommend be done?
What are the implications of these tests to the Company?
What do you propose be done now?

Next, materials and processes:

What are the properties, characteristics, capabilities?
What are the limitations?
What are the use requirements?
What is the area and scope of application?
What are the cost factors? Major?
How available is the material or process?
Is there another material or process that will accomplish the same result?
How and where is the material or process best used?
What are the problems in using the material or process?
What is the significance of the application to the Company?

Finally, field troubles:

What equipment was involved?
What was the trouble that developed?
How much money and time is involved?
Is there any trouble history on this product?
Whose responsibility to repair and place in service? Company? Others?
What action is needed?
Are there any special requirements to be met?
Who does what?
What are the time factors?
What is the most practical solution?
What action is recommended?
What product design changes do you suggest?

In addition to these technological matters, a manager must also consider market factors and organizational problems. Although these are not the concern of the engineer, he should be aware of their importantce and should furnish information to management whenever technical aspects provide special evidence or insight into the problem being considered. For example, here are some of the questions about marketing matters an engineer's supervisor will want answered:

What are the chances for success?
What are the possible rewards? Monetary? Technological?
What are the possible risks? Monetary? Technological?
Can we be competitive? Price? Delivery?
Is there a market? Must one be created?
When will the product be available?

And, here are some of the questions about organization problems a manager must have answered before he can make a decision:

Is it the type of work Westinghouse should do?
What changes will be required? Organization? Manpower? Facilities? Equipment?
Is it an expanding or contracting program?
What suffers if we concentrate on this?

These are the kind of questions Westinghouse management wants answered about projects in these five broad technological areas. They are questions that must be answered if the engineering report is to be a useful instrument in the decision-making process.

Level of Presentation

I should now like to turn to an aspect of report writing that is tremendously important — the technical level of presentation. I do not intend to get into semantics and syntax, for that is outside the scope of this paper; I wish to deal solely with the communications aspects of language.

Trite as it may sound, the fact remains that the technical and detailed level at which a report should be written depends upon the reader and his use of the material. Most readers, certainly this is true for management readers, are interested in the significant material and in the general concepts that grow out of detail. Consequently, there is seldom real justification for a highly technical and detailed presentation.

Usually the management reader has an educational and experience background different from that of the writer. *Never* does the management reader have the same knowledge of and familiarity with the specific problem being reported that the writer has. *Therefore, the writer of a report for management should write for a reader whose educational and experience background is in a field different from his own.* For example, if the report writer is an electrical engineer, he should write his reports for a person educated and trained in chemical engineering, or mechanical engineering, or metallurgical engineering; not in electrical engineering.

If the report is to convey information effectively, all parts of it *should preferably* be written at the level of articles published in THE SCIENTIFIC AMERICAN. And, all parts of the report, other than the body and appendix, *must* be written at THE SCIENTIFIC AMERICAN level. The highly technical, mathematical, and detailed material — if necessary at all — can and should be placed in the appendix.

A report to management is an instrument of communication, a vehicle used to communicate information about technical matters to management. If reports are to convey information efficiently, the writer must understand how they are to be used and he must know the educational and experience background of the readers. This is the primary consideration in report writing; others are secondary.

WHAT WE DID WITH THE INFORMATION

Up to this point, I've been concerned mostly with the findings of the report-writing project. Now, I want to tell you a little about what we've done with these findings.

So you won't be misled by what I'm about to say about report-writing guides, let me assure you that a "guide" — as distinguished from a "manual" — was our objective from the very beginning of the study.

However, in reviewing the results of the study, we quickly recognized that the responsibility for accurate and useful reports did not lie solely with the author; management had some responsibilities as well.

Therefore, instead of developing one report-writing guide as originally planned, we developed two:

1. *Managing Report Writing*: In this guide, management's responsibility to the writer is defined as it relates to the supervision of the project and the required reports. Also included are the procedures for directing report-writing assignments.
2. *What to Report*: In this guide, the author's responsibility to management is defined as this relates to content and level of presentation. In addition, the informational needs of management are covered in detail for the five broad technological areas of interest:
   a. Technical problems,
   b. New projects and products,
   c. Experiments and tests,
   d. Materials and processes, and
   e. Field troubles.

I'm sure you're aware from this brief description of the two guides that I've already covered the "What to Report" guide in considerable detail. However, the "Managing Report Writing" guide requires additional comment.

First, the management guide states the company policy for engineering reports, placing the responsibility for effective reporting squarely on the shoulders of management. It further defines management's responsibility in the reporting process as one of:

1. Defining the project and the required reports,
2. Providing proper perspective for the project and the required reporting,
3. Seeing that effective reports are submitted on time, and
4. Seeing that the reports are properly distributed.

Lastly, the guide recommends a procedure for supervising report writing. So far as the individual supervisor is concerned, this will prove to be the most useful part of this guide.

Most supervisors, although they may write well themselves, are lacking in the skills needed to ensure the kind of report they want. They are unaware that they must:

1. Understand the writing process, and
2. Establish check points that will effectively control the reporting process.

An engineering report, like any engineered product, has to be designed to fill a particular need and to achieve a particular purpose within a specific situation. There are no secret formulas having to do with format and organization. In order to write effectively, a writer must know how the report is going to be used and who is going to use it. These things are basic to any communicative process. Making sure that the writer knows what his report is to do, how it is to be used, and who is going to use it—is the responsibility of management.

While each of these two report-writing guides is concerned with a different function — one supervision, the other authorship — their purpose is the same: to clearly define basic responsibilities in the reporting process. The failure of the supervisor or of the author to do the job expected of him means a breakdown in the reporting process. And when this happens, the guides can be used to determine where the breakdown occurred.

Throughout this study, we were impressed with each manager's desire to bring about an improvement in the reporting process. Each one expressed the hope that the presentation of the guide to the managers and to the engineers would be made with the understanding that it could be voluntarily adopted in whole or in part — or rejected outright. Each manager strongly urged against proclaiming the guides as an official part of the Company's policies and procedures. Rather, they felt strongly that if the benefits to the manager and to the author were great enough, the guides would ultimately become an unofficial part of the Company's policies and procedures. We have taken the managers' counsel and are presenting the guides for voluntary adoption.

I cannot tell you now that these guides are a "success." Nor can I tell you they are a "failure." Not enough time has elapsed since the study was completed in August to determine that. But I can tell you that the reactions have been most favorable and enthusiastic where the guides have been presented. If we gain voluntary adoption throughout the Company, we can look forward to more meaningful and useful engineering reports. And this, after all, is the reason for undertaking the study in the first place.

WHAT THE TECHNICAL AUDIENCE WANTS

by Joe W. Kelly
Professor of Civil Engineering
University of California, Berkeley

A study of the organization of the technical report from the standpoint of the technical audience: who is going to read it, what should be included, the place of illustration, what should be left out, and the importance of a concise conclusion.

As a civil *engineer,* I was at first hesitant to discuss what a *scientific* audience wants of a technical report, as originally requested by Mr. Littell. But he and I compromised on a *technical* audience; after all, engineers are becoming more scientific and scientists are becoming more practical, or at least they are becoming more concerned with engineering applications. The scientist develops new relationships, and the engineer makes economic use of them, so the two groups must work together. Both must report their work in usable form for others.

Some general principles of reporting will apply to whatever field of engineering or science is involved, and to technical papers as well as technical reports; therefore I shall primarily discuss principles rather than details. Particularly I have in mind the principles of orientation, completeness, exclusion, and comprehensibility. Much that I shall say is already familiar to you, but your programming of the subject indicates that you consider a review of principles worth while.

ASSUMPTIONS

Some of the best-known principles can be passed over very lightly in this group of specialists. We can take for granted that a technical audience wants reports to be useful, accurate, concise, well organized, in logical order, in respectable English, and with correct and consistent mechanical details. We already know that in general a report involves successively some identification and orientation; the philosophy or the problem; the background, including the chronology and the state of the art; the new concept, that is, the plan; the conditions under which the plan is worked out; the implementation of the plan; the results; the significance of the results; the conclusions, both specific conclusions from the particular program and general or continuing relations justified by it; recommendations for action, and almost invariably recommendations for further study; and references to other sources of information on the subject.

ORIENTATION

When the technical man picks up a report, he needs orientation. He thinks: What is this? Why is it written, and why should *I* read it? How will it affect *me?* Orientation is accomplished by front-matter devices such as title page, letter of transmittal, table of contents, and synopsis; but orientation needs to be continued into the text itself. Especially important are the first sentence, the first paragraph, and the first page. The reader needs to be funneled in from a wide range of interests, technical and nontechnical, to a fix on the message he needs to be told. Even within sentences throughout the text, the limiting conditions should be stated at the beginning of the sentence in order to orient the reader for the punch clause. It is annoying and time-wasting to read a long involved sentence only to find at the end that it applied to something in which he is not interested.

A masterpiece of orientation is the first four sentences of Lincoln's Gettysburg address. "(Many) years ago, our forefathers brought forth . . . a new nation . . ." establishes contact with the word "our" and orients us in time and space. "We are now engaged in a great civil war, testing whether (that) nation . . . can long endure," orients the time to the present. "We are met on a great battlefield of that war," narrows the space concept; and "We are here to dedicate a portion of that field . . ." gets us down to the business at hand.

The principle of orientation applies not only to the reader but also to the writer. Too often the writer simply writes to a vague general audience hoping that those who run will read, whereas he should consider whether he is aiming primarily at nontechnicals, general technicals, or specialists, and he should adjust his content and level of presentation accordingly. Once I was assigned by my employer, a trade association, to write one of their many brochures on a special kind of material. When I asked the office manager, who had charge of the mailing lists, to whom such a booklet would eventually be mailed, he nearly fainted; in many years nobody had thought to ask him such a question.

The principle of orientation applies throughout the report. The reader needs to be given enough background to enable him to understand the conclusions, and he needs to be kept on the track of thought by frequent and consistent headings.

COMPLETENESS

Another important principle is that of completeness. For the technical man, usually the report should include considerably more detail than for management. To be useful to the technical man, the report should give conditions sufficient for replication of tests or experiments. He wants to know not only the results but also how they were obtained, if they are dependable, and if they are comparable to work that he has done or intends to do. Such information is provided by describing the test conditions and the computations with sufficient detail to allow checking within reasonable limits.

If the material intended for the technical audience can be well separated from that for other readers, it can be relocated to the appendix, or even to a separate report. For example, the final report on a comprehensive research project on airport pavements at Hamilton Field was published as two reports — one for everbody including specialists, and one entitled "Instrumentation" for specialists only. In this situation, the variety of instrumentation and the development of new apparatus were subjects of major interest because similar investigations were being planned elsewhere. In some investigations, the detailed data are so voluminous that they are best published separately — as inexpensively as possible — for limited distribution to specialists.

Completeness also implies that the text will be supplemented by ample graphic aids — drawings and photographs for descriptions, charts and diagrams for comparisons and progressive phenomena, and tables for the record.

Further, for the technical audience the report should point out the availability of special aids such as computer programs and statistical samplining series, even though these may not be described in detail in the report. A carefully selected list of published references, preferably annotated, is also helpful to make the report more complete by extension.

In modern papers and reports, often the programming is an important part of the message. My daughter, a mathematical statistician, has coauthored several research papers with scientists, to which papers her contribution was entirely the programming.

I try to keep completeness in mind when criticizing or editing a manuscript for a colleague, as I am frequently asked to do. Whatever the manuscript contains may be in good form and order, but I ask myself, "What is *not* here that should be?" Some of my most appreciated suggestions — and incidentally they hurt no one's feelings — are "How about inserting something on so-and-so?"

EXCLUSION

To balance the positive principle of completeness, there is a negative principle which I call "exclusion." The writer should ask, not only "Is everything here that should be?" but also "What can be left out?" I refer here to complete subjects or parts of the report as well as to details. Perhaps the report itself shouldn't be written at all!

The criterion of usefulness should be applied throughout.

To illustrate the principle of exclusion, a classic paper in the field of civil engineering was "Analysis of Continuous Frames by Distributing Fixed-End Moments," written by Professor Hardy Cross of the University of Illinois and published in the Transactions of the American Society of Civil Engineers in 1932. The content of the paper became the basis for much of present-day structural design; but more important to us here is its scope. Professor Cross began with a list of 17 items which he did *not* intend to cover, before he stated his new method. The paper, which was only 10 pages long, provoked a phenomenal 146 pages of discussion including 18 pages of author's closure — none of which discussion significantly modified the basic message of the original 10 pages with the 17 exclusions.

In some cases, material which could well be excluded is included merely to impress the reader with presumably thorough coverage. It was once the practice of a certain engineering firm to append to its reports to clients voluminous preprinted descriptions of test methods many of which were standard and widely published, and which could have been referenced concisely if they were needed at all.

Throughout the text of the report, the writer must be on guard to exclude, on the one hand, details that would be welcomed by the specialist but would confuse the generalist, and on the other hand, general statements that would be sufficient for the generalist but would be thin or equivocal for the specialist. He should not be carried away by some pet derivation or method of computation, or by some complicated type of graph or table that would confuse rather than illuminate. He should be merciless in striking out words, sentences, and paragraphs wherever they can be spared; the reader is entitled to directness and simplicity.

COMPREHENSIBILITY

Comprehensibility is a big word (17 letters), but it is in the dictionary and it is a valuable principle of technical reporting. The main purpose of a technical report or paper is to convey a message — what Mr. Littell discussed with me as a "take-home lesson." That message should be in concise comprehensible form. If the reader doesn't "get the word," then probably the report should not have been written. Somewhere, somehow, it must tell him what he needs to know, with unequivocal clarity. I recall one report from Professor Raymond E. Davis of the University of California to the Research Corporation, which said in the brief letter of transmittal, "The outstanding result of the investigation is . . . ." In a comprehensive investigation of various existing and proposed types of cement which might be used to build Bonneville Dam, he stated in the conclusions of a 350-page report that, all things considered, the portland-pozzolan type of cement should be employed. This was successful engineering, as the dam was so built and is still in splendid condition; and it was successful reporting in that the consulting board had a specific recommendation to approve or reject without ifs, ands, and buts.

The message may be in the form of a sentence or a paragraph; it should never exceed a page. The late Professor Raber of Mechanical Engineering at the University of California used to say "Every engineering report should be written on one page; the rest is supporting evidence." I have long found the one-page limit useful in submitting outlines and plans for extensive reports, as well as for writing letters; it seems that whatever is on one page will be read and comprehended as a unit, whereas the prospect of turning pages lessens the intensity and scatters the interest.

CONCLUSION

In conclusion, I hope that this presentation of the principles of orientation, completeness, exclusion, and comprehensibility has indicated to you what the technical audience expects of a technical report. The technical requirements differ from those of management and other nontechnical readers in that they require less background, more detail, and a greater precision of statement and of numerical values. I am gratified to see that your society is dedicated to improvement of verbal, symbolic, and graphical communication in general, and of technical reports in particular; and I wish you all success in your important mission.

WHAT MANAGEMENT THINKS THE SPONSORING AGENCY WANTS

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This report (1) examines some of the things the sponsoring agency says it wants, (2) finds certain inconsistencies in these stated requirements, (3) re-examines the requirements in terms of certain sponsoring agency personnel, (4) finds the requirements to be largely valid, and (5) suggests ways of satisfying these requirements.

Most of you in the audience today are communications specialists. I am sure, therefore, that you are aware that the title of this paper, "What Management *Thinks* the Sponsoring Agency Wants," is a semantic absurdity. It implies that I am going to discuss two personified generalizations named, respectively, "management" and "sponsoring agency" — and, in an authoritative manner, tell you what one of these generalizations *thinks* that the other one *wants!*

APPARENT INCONSISTENCIES IN AGENCY'S DEMANDS

But let us go along with the game for the moment. Let us begin by examining what the generalized entity, the "sponsoring agency," *says* it wants in its reports. The sponsoring agency tells us about its needs largely through four inputs: (1) through the reporting requirements called out in contracts issued by the agency; (2) through report specifications and exhibits referenced by such contracts; (3) through instructions given by representatives of the sponsoring agency to amplify or clarify contract requirements; and (4) through feedback, or perhaps I should call it "kickback," provided by representatives of the sponsoring agency after reports have been delivered to them.

Let us examine these four inputs in some detail:

1. The reporting requirements called out in formal contracts are usually limited to a bare listing of the number and kinds of reports required and the dates on which they are due: so many monthly progress reports due on the 10th of each month, so many flight test reports due 45 days after receipt of final flight data, an annual report due on the 15th of July, and so on. There may be a sentence or two defining what is to be included in each type of report, but usually the contract discusses the subject coverage in only a very general way.
2. The report specifications and exhibits which accompany the formal contract usually spell out in considerable detail the desired "standard parts" such as abstract, preface, introduction, and conclusions; the desired format, typography, artwork, and reproduction processes; and various other matters concerned with the form, rather than the content, of the re-

ports. As in the contract, any reference to subject coverage — its scope, technical level, and degree of detail — is limited only to general terms.

3. On the occasions when representatives of the sponsoring agency provide further amplification of contract requirements, their instructions often take the following line:
   a. Don't give us long reports: be selective in technical detail; just give us summary material and your evaluation of significant technical findings.
   b. Don't prepare fancy reports: all we ask is that the text and figures be legible; hold costs to a minimum.
   c. Give us full coverage, including both proprietary and nonproprietary information.
   d. Above all, keep us currently informed: deliver reports promptly on schedule.
4. On the occasions when the reports have been prepared according to the foregoing instructions, the "feedback" from representatives of the sponsoring agency usually falls into this pattern:
   a. Your reports are too brief; the documentation is incomplete; there is insufficient substantiating detail.
   b. The quality and workmanship is below standard; the reports do not conform to specifications.
   c. You should not have marked your reports "proprietary"; we want to show them to your competitors.
   d. We appreciate your delivering the reports on schedule; however, the information in them was not current as of the date of delivery.

To sum up, then, the following is apparently what the sponsoring agency *says* it wants:

1. It is usually quite explicit on the number, kind, and due dates of the reports, and on the standard parts, format, and reproduction mechanics desired.
2. It does not want long reports and prefers only summary material, but it wants complete documentation and full technical detail.
3. It does not want fancy reports and insists on minimum cost, but the reports must be of top quality and must comply fully with specifications.
4. It wants complete information, including proprietary data, but the reports must be available for dissemination to competitors.
5. It wants all reports delivered on schedule, but the information in the reports must be current as of the dates the reports are due.

REQUIREMENTS IN TERMS OF AGENCY PERSONNEL

At this point we had best abandon our personification of the sponsoring agency as a single generalized entity. Otherwise, the split personality now apparent from the agency's stated requirements will lead us only to the conclusion that our fictitious entity needs to consult a psychiatrist. The truth is, of course, that the sponsoring agency is not a single entity, but, rather, is a collection of people, each having his own problems and requirements with respect to reports. Until we consider the individual needs of these separate people, we will never be able intelligently to answer the question "What does the sponsoring agency really want?"

First, there are the administrative and fiscal men in the sponsoring agency — the contract administrators, budgeters, schedulers, and controllers. These men are not concerned with the technical subject matter; their job is simply to see that the required reports are contracted for, that costs and schedules are controlled, and that the sponsoring agency gets what it pays for. They are the ones who write the contract requirements, and this is why the contract emphasizes only the number, type, and due dates of the reports desired — requirements which can be checked off as being either met or not met, without the need for qualitative technical evaluation.

Second, there are the publications people in the sponsoring agency. These are the ones who have to take the contributions from dozens, or sometimes hundreds, of contractors, and publish or release these contributions in some semblance of a unified reporting system. Naturally they want these contributions to be in a standard form and as nearly complete as possible. They are the ones who provide the report specifications and exhibits accompanying the contract, and they are the ones who object when the delivered product fails to meet these requirements.

Third, there are the project managers and their bosses, the program directors, in the sponsoring agencies. These managers are technical men, but they are primarily interested only in the over-all technical progress and results. They leave it to their technical subordinates to keep abreast of, and evaluate, the detailed technical findings. These project managers are also vitally interested in keeping informed on project progress on a day-to-day basis, on holding down project costs, on coordinating the work of one contractor with related work being done by other contractors, and on similar matters affecting over-all project management. They are the ones who, thinking primarily of their own needs, often give the instructions to the contractor to emphasize the over-all summary reporting, to hold reporting costs to a minimum, to tell all — proprietary and nonproprietary, and to report today's progress today.

Finally, there are the lower echelons of technical men in the sponsoring agency — the ones who have the detailed responsibility for one or another segment of the over-all project, and the ones whose technical recommendations provide the basis for the larger decisions of the project and program managers. These are the men who want the complete documentation and full technical details of the work they are responsible for, and who want to be free to discuss these details with other contractors working on related parts of the program. They are the ones who generally make the "feedback" complaints when the reports contain too little technical detail or are marked with the limiting stamp, "Proprietary Information." They, too, are interested in holding down costs and keeping currently informed, but, above all, they want the complete technical story.

WHAT THE AGENCY REALLY WANTS

Now that we have stopped thinking of the sponsoring agency as a single entity and have sorted out the individual problems of some of its people concerned with reports, we are finally in a position to approach intelligently the original question, "What does the sponsoring agency want?" At the same time, having established the agency's requirements, we are in a position to discuss ways and means of best meeting these requirements.

I believe we can safely start by "nailing down" certain points about which there is little or no ambiguity in what the sponsoring agency says it wants. The requirements for the number, types, and delivery dates of the reports, as specified in the contract, certainly are without ambiguity. Likewise, the requirements for the format, typography, artwork, reproduction processes, etc., as called out in the report specifications, should be considered a "must." It is true that the specification requirements conflict somewhat with the project manager's instructions to "hold costs to a minimum — all we ask is that the text and figures be legible." However, the need for standardization and quality in reports is undeniable — even if we sometimes think the specifications go a little too far. At any rate, when the specifications are called out in the contract, we have little real choice except to follow them.

With these points out of the way, we can now concentrate on the three main areas where the sponsoring agency's left hand seems to disagree with its right hand, or where the requirements seem to be somewhat unreasonable to the contractor. These are: (1) the question of short, summary-type reports versus long, detailed, and fully documented reports; (2) the question of proprietary versus nonproprietary coverage; and (3) the question of currency of information (cutoff date) versus delivery date.

Regarding the first of these questions — summary reports versus detailed data — we must conclude that the sponsoring agency really wants both kinds of information. Both the project manager and the technical detail men in the sponsoring agency have legitimate needs for their respective requirements, so it is up to the contractor to meet these needs. There are several ways to meet this dual requirement. In a short report, an expanded summary section in the front of the book can be provided to satisfy the project manager's needs; the body of the report can then tell the detailed technical story. Or, if there is a large amount of detailed data, the report itself can be written as the summary, and the detailed documentation can be presented as an appendix. If it is a very long, or multivolume, report, the summary material can be presented in a separate summary volume expressly written for the project manager, with the detailed technical story for the subordinate technical men presented in the other volume or volumes of the series. Exactly which of these approaches to use will depend upon the material reported on and upon the preferences of the affected sponsoring agency personnel; the important thing is to recognize the need for, and provide, both kinds of information.

Regarding the second question — proprietary versus nonproprietary coverage — again we must admit to a legitimate need to supply both kinds of information. The project manager certainly needs to know all of the available state of the art — however it was generated and financed — which might help him reach his project objectives. It is both good patriotism and good business to supply him with such information. At the same time, both the project manager and his subordinates also have the legitimate right to disseminate to competitive companies any technical information that is not proprietary and that might help in coordinating the over-all technical program. So it is up to the contractor, again, to meet both requirements. The problem here is to keep the proprietary information in a separate package from the nonproprietary, so that the first will go no farther than the sponsoring agency but the second will be readily available for industry distribution. The two alternative solutions that immediately suggest themselves, of course, are (1) to present the proprietary information in a separately bound supplement to the main report, which is kept nonproprietary, or (2) to prepare two separate versions of the complete report, one proprietary and the other nonproprietary. There may be some objections to the second alternative on the grounds of the added cost, but in my own experience I have observed that it provides results that seem to give the maximum satisfaction to all concerned.

Regarding the third question — information cutoff date versus report delivery date — there is no question as to what all parties in the sponsoring agency want, but there is a practical limit to what the contractor can deliver. The problem is really to eliminate excessive delays in delivery and hold the "publications lag" to the smallest practicable time span. The solution is to streamline publications operations to the utmost and to work out an orderly means of inserting last minute information just before the delivery date. It is probable that the sheer mechanics of the writing, reviewing, publishing, and transmittal processes will always necessitate a time lag of a day or so for short reports and several days for longer ones, but certainly there is room for improvement in the operations of most reporting organizations. It is the excessive delays that have raised the question in the first place; if we can eliminate these, I believe we will be giving the sponsoring agency essentially what it wants.

We have now (1) examined some of the things the sponsoring agency *says* it wants, (2) found certain inconsistencies in these stated requirements, (3) re-examined the requirements in terms of the individual needs of certain sponsoring agency personnel, (4) found the requirements to be largely valid, and (5) suggested ways of satisfying these requirements. Admittedly we have not covered all of the problems of reporting — in fact, we have confined ourselves only to a few problems representative of those encountered by publications departments of industrial firms working on military R and D contracts. However, within these limits, we have answered our question, "What does the sponsoring agency want?" The reply, we have found, is simply, "In spite of any apparent inconsistencies, the sponsoring agency wants exactly what it says it wants."

As for the first part of our original title, "What Management *Thinks* the Sponsoring Agency Wants," obviously I have been acting as the personification of management and telling you what *I* think the sponsoring agency desires. The next speaker will personify the sponsoring agency itself, and will give you the straight dope on what the sponsoring agency *really* wants.

MANAGING THE TECHNICAL REPORTING FUNCTION

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An analysis of why the technical report has evolved and the purpose it serves. The six basic processing functions are discussed: production, distribution, announcement, organization, storage, and retrieval. Much that is classed as technical reporting is not technical, and standardization is long overdue. Much remains to be done to streamline our national scientific and technical information communication system.

A major portion of today's scientific research and development effort involves the relationship of a sponsor and a doer — the sponsor being the organization that supports the work and wants it done, and the doer being the organization that does the work under a contract or grant. In such a relationship effective communication between the two parties is obviously necessary, especially since they are usually far removed from one another.

This information communication process, commonly referred to as technical reporting, is generally thought of as being a one-directional, closed circuit flow system, that is, from contractor to sponsor. For certain types of information this is true, as I will point out later, but since we are concerned with the subject of scientific research and development and its principal product, scientific and technical information, there are other important dimensions that must be considered. I shall attempt, therefore, to give you my views on what I feel are the major elements of the over-all scientific and technical information communication system, and to point out the significance and responsibilities of the technical reporting function within that system.

WHAT THE SPONSORING AGENCY WANTS

First, let's briefly consider the types of information that are needed by a sponsoring agency for the planning, administration, and conduct of its research and development program.

I might state now that I have not attempted to select any particular agency as a typical example, nor shall I even presume that, for all agencies, there is one general answer to the question: What does a sponsoring agency want in the way of information? Any attempt at such an answer would be like trying to speak to the question: What do people like to eat? The only appropriate responses you can give to these two questions are *good food*, and *useful information*. Because all sponsoring agencies have different information needs and wants, just as they all have different methods of managing their research and development programs, I shall be even more general. I shall confine my remarks to what I feel are the types of information and reports that are needed or wanted by most sponsoring agencies.

In order effectively to manage and carry out a scientific research and development program, a sponsoring agency needs information from two sources: (1) from the R and D projects that it supports, and (2) from similar R and D projects sponsored by others. From each project that it supports, the agency needs information which will provide the answers to the following four general questions:

1. How near is the project to completion?
2. What are the present and expected problems?
3. How much money has been expanded?
4. What are the signicant scientific and technical results?

From the projects sponsored by other agencies, it wants to know *only* those scientific and technical results that relate to its subject area of interest. Having obtained the scientific and technical information from both these sources, the sponsoring agency is then faced with a fifth question: How can the results be effectively utilized in furthering the agency's objectives?

WHY REPORTS ARE NEEDED

To enable sponsoring agencies to obtain the answers to these five questions on a timely and effective basis, a new communication device was contrived — the technical report. Ever since its adoption into the scientific and technical information family some twenty odd years ago, the technical report has been treated as the odd-ball of the family. Shunned by its more sedate brothers and sisters — the journal and book literature; ostracized by most of the conservative institutions of its society — the conventional libraries and abstract and index journals; and neglectfully managed by its parents — the research and development community; the technical report has proliferated into an entirely new family of literature.

Now, why has the technical report survived and continued to grow against such odds? The obvious conclusion is that it performs an essential information function within the research and development community. With the rapid pace of our present research and development activity, and where today's planning of new research projects depends not only on yesterday's research results but on today's as well, can we afford to continue to treat the technical reporting function lightly?

I have heard it said that if it weren't for this relationship of contractor to sponsor there would be no technical reports at all. Of course there wouldn't — there would be practically nothing to report. Such remarks infer that the sponsoring agency, because of its need to be informed of the work it is supporting, is responsible for all the many information communication problems created by this literature misfit we have come to call the technical report. In my opinion the contractor and sponsoring agency both share a large part of the responsibility or blame for many of these problems.

This brings me to the primary thesis of my paper: What can be done to make the technical report literature a more effective and compatible communication media within our over-all scientific and technical information communication system? First let's see what this system looks like.

THE SCIENTIFIC AND TECHNICAL INFORMATION COMMUNICATION SYSTEM

In general, the scientific and technical information communication system or process consists of six basic processing functions: (1) production, (2) distribution, (3) announcement, (4) organization, (5) storage, and (6) retrieval. The relationship of these functions to one another can be illustrated by means of my own simplified definition of the system as it exists today, which is: Communication of recorded scientific and technical information consists of *producing* appropriate documentary records of research and development results and making such records available by *distributing* them to known users, *announcing* their existence and availability, and providing copies to all major authorized activties engaged in *organizing*, *storing*, and *retrieving* such documents and information for current and future use.

This definition is useful to me because, in effect, it places the functions in the general chronological order in which they are performed in the system, and shows how each is dependent upon the others. It also simplifies the problem of determining where all the many information processing subfunctions fit into the system. These include such tasks as abstracting, indexing, translating, filing, publishing, and the like. Most of these subfunctions can be carried out at any place in the system, but the purpose for which each is performed dictates the major function to which it belongs. For example, indexing is performed for the purpose of organizing information for storage and retrieval, and therefore is a part of the organization function. Likewise, publishing is a part of the production function.

IMPORTANCE OF THE TECHNICAL REPORTING FUNCTION

Now let's see where technical reporting fits into this scheme. Since it involves the act of recording scientific and technical research results for the purpose of communicating them to others, it obviously *is* the first major step of the communication process, that is *production*. In addition, most activities engaged in producing technical reports are also involved with their initial distribution, the second major function. Many producers also maintain their own announcement service, or distribute copies of new reports to outside announcement services. Thus, the report-producing activities play a primary role in the first three major processing functions in the communication system.

Since the technical reporting function is the first step of this large and complex system, it also is the cause of many of the headaches and frustrations that occur in the handling and use of technical reports in all other steps of the communication system. By the same token, however, the technical report producers, in cooperation with the sponsors, are also in the best position to improve this situation. Much of this improvement could be realized if both would recognize the shortcomings in the technical reports which they generate, devote more attention and effort to make their reports more useful and manageable, and assume their share of the responsibility for the over-all improvement of the scientific and technical information communication system of the U. S. By adopting such a role, the producers and sponsors would actually be benefiting themselves, in that both are the greatest users of scientific and technical information, especially that contained in technical reports. In effect, therefore, they are in the position of resolving many of their own information problems.

THE NEED FOR IMPROVING THE TECHNICAL REPORT

Getting more specific, I would now like to point out some of the characteristics of technical reports that detract from their effectiveness as a scientific and technical information communication media. Many of the factors that I will mention may appear elementary to those of you who are concerned daily with the prepration of technical reports. In fact many of them may even seem relatively unimportant alongside some of your problems. It is these seemingly minor and inconsequential factors, however, that, when added together become significant. Their cumulative effect is what has made the technical report the maverick that it is.

Further, I might add there is nothing really new or revolutionary that one can say about these factors because most of them have been discussed and written about by many people before me. For example, a recent paper by one of my colleagues, Dr. Dwight Gray, points out in specific terms many of these same areas where technical reports can be improved.[1] Paraphrasing a well-known quote concerning the weather, everyone talks about it but nobody does anything about it, the same can be said concerning the technical report. Even this analogy is no longer valid, however. Weather modification research is a going concern.

As Dr. Gray so aptly puts it, "U. S. technical reports have as almost their only common features that they are printed in English and come out as pamphlets of rectangular cross section."[1]

ARE YOUR TECHNICAL REPORTS TECHNICAL?

Referring back to my discussion of what a sponsoring agency wants, you may recall that of the five questions for which he needs answers, only two are concerned with scientific and technical information. These two are: What are the significant scientific and technical results of the projects that I am sponsoring? and, How can these results, as well as those of projects sponsored by others, be effectively utilized in furthering my agency's objectives? It is not too difficult to see that it is these two questions which provide the basis and need for our whole scientific and technical information communication system, especially the technical reporting portion of that system.

The information needed by the sponsor to answer the other three questions on the progress, problems, and cost of his research projects is purely administrative in nature, and as such, is of interest only to him and the contractor. This brings me to ask the question: "Is it necessary that we label or refer to every piece of paper generated and exchanged on an R and D project as a technical report?"

By my interpretation, as well as that of many others, the word *technical* in the term *technical report* is intended to convey that the contents of the report contains scientific and technical infor-

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[1]Dwight E. Gray, "Technical Reports I Have Known and Probably Written," *Physics Today*, Vol. 13, No. 11, pp. 24-26, 28, 30, 32. (November 1960).

mation. But, is this actually the case? From my experience with handling and using so-called technical reports, I find that, in too many cases, the technical content is completely missing, or has been so diluted with adminstrative-type information that it has become completely masked. I'm sure that much of this is a direct result of the reporting requirements laid down by the sponsor to the contractor. I'm also sure that there are cases where a contractor has nothing scientific or technical to report, but, because of the sponsor's rigid reporting requirements, or other reasons, the contractor is obligated to report that he has nothing to report. I have seen "technical reports" of this nature.

What effect do such practices have on the effectiveness and efficiency of our over-all scientific and technical information communication system? The answer is obvious when one considers that most of these "nontechnical" reports carry a highly technical title, as well as a technical label, and that they are surely to be introduced into the system just like any others. The time and money unnecessarily wasted by scientists, engineers, technical librarians, and information processors in the acquisition and handling of these "nontechnical" technical reports are themselves sufficient grounds for questioning such practices. As we all know, quantity of words and paper is one of the major factors causing our scientific information system to bog down. Must we continue to increase this quantity by the addition of nontechnical matter? Or better yet, is it possible and practical to separate the significant and new scientific and technical information from the nontechnical type, and to issue each as a separate document, with appropriate identification labels? I feel that the technical report producers and sponsors have the responsibility and capability for achieving such a goal. In my opinion, both would benefit greatly.

ARE YOUR TECHNICAL REPORTS IDENTIFIABLE?

In our complex scientific and technical information communication system made up of a multitude or organizations involved in producing, handling, and using technical reports and other documents, it is essential that each such document be easily and uniquely identified from all the others. To persons involved in processing and searching for our present report literature, this is a very real problem.

First, let's look at the matter of report labeling and numbering. For my own edification I scanned a recent issue of a well-known abstract journal devoted exclusively to technical report literature. My immediate conclusion was that the term *technical report* is obviously only a generic descriptor for a whole host of document species and related hybrids. The number and variety of combinations of words that are used to label or name a "report" aroused my curiousity, so I selected 30 of the most commonly used words and divided them into three groups of 10 for further analysis. In the first group I placed those words used to indicate chronological sequence (interim, monthly, final, etc.); in the second, those most frequently used as descriptive modifiers (development, engineering, progress, research, etc.); and in the third, those which referred to the type of document (note, memorandum, paper, report, etc.). On the basis of a simple mathematical analysis, I calculated that there is a maximum of 6,160 possible report names that can be made from this sample of 30 words. From my experience in working with report literature, and from just scanning this one abstract journal issue, I would venture a guess that we have already exceeded this figure. On this matter of report numbering and coding systems in current use, I shall not even attempt such a guess. The multitude of such systems used by all the various report-producing activities and sponsoring agencies is even more astonishing. Uniformity and standardization in these areas are long overdue.

Now, what about titles? To most users the title of a report is considered the first clue as to what the report is about. Therefore, the title should give the prospective user a good indication of the subject contents of the report. Many titles, however, appear to go out of their way to mislead, rather than to direct the user. Since the report is prepared for the purpose of informing users, why not, whenever possible, construct a title with the user in mind also?

Report names, numbers, and titles are only three of the elements that provide handles for the identification of reports. There are others, such as contract number, name of sponsoring agency, name of contractor, personal author, and date of report, but for purpose of brevity I shall not comment on them except to say that they also should always be clearly indicated on the title page of the report.

ARE YOUR TECHNICAL REPORTS AVAILABLE?

In general, a technical report cannot realize its full value until its information has been made available for actual or potential use by the entire scientific and technical community. Of course this principle can be applied only to unclassified information.

In this connection, the producers of technical reports can perform an important role. For example, producers can assist by giving appropriate consideration to the practicability of separating classified information from unclassified information, thus permitting more widespread dissemination of the unclassified contents of reports. In many cases this is not practical, but it is worthy of continuous attention. Another way in which producers can improve the availability of reports is by ensuring that new ones are printed in sufficient copies and are adequately distributed, especially to those major activities in our information communication system that are engaged in providing announcement, organization, storage, and retrieval services.

ARE YOUR TECHNICAL REPORTS ABSTRACTED?

There are also other areas in which report producers can provide valuable assistance in improving the effiiciency and effectiveness of the whole information system. Two of these are abstracting and indexing. I mention them only briefly because their significance is apparent, and also because a great deal of progress has already been made in one of them — the inclusion of author abstracts in reports. On the basis of this success, the inclusion of author-suggested subject index terms may also be worthy of consideration. Another problem area which report producers can help to eliminate concerns the physical characteristics of reports which hinder or prevent their effective photo-reproduction.

WHERE DO WE GO FROM HERE?

It may appear that I have overemphasized the state of affairs concerning some of these technical report problems, and I admit that I very well might have. I'm sure that there are many organizations that have devoted considerable attention to many of the problems I have mentioned, and have already taken steps to resolve them. Nevertheless, there is still much to be done, and if we are ever to achieve any major degree of success in streamlining our national scientific and technical information communication system, it will require the full cooperative participation by all the functional elements of the system. The technical reporting or production function is one of these elements, and therefore must provide its share of the effort and impetus to achieve such a goal.

PANEL 7 — HOT TYPE — COLD TYPE

TYPESETTING IN THE TWENTIETH CENTURY

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Vice-President (San Diego)
Mercury Typesetting Company

Starting in the 1880's typesetting was a very simple thing. It was all done by hand, and as men in the trade look back now, we realize it was quite an art.

With the coming of the Monotype machine to set tariff and the Linotype machine for straight matter, the hand compositor, then as now, also thought these machines were going to put him out of business.

In recent years the Photosetting machines have come upon the scene (the Photon machine, the Lino Film machine, Intertype's Photosetter, and A.T.F.'s Hadego), and again the hot type typesetter thought he was going to be put out of business.

Around 1920 and into the late 1930's, the offset printing method became a practical thing, and again the cry went up — "Boy! Now we don't have to worry about the typesetter; now we can paste up everything, take a shot, make a plate, and we're in business!"

About this time a phrase began to appear —"COLD TYPE." Again the competition was going to put the hot type typesetter out of business. Let me make it clear that there is no such thing as "COLD TYPE," especially if you're sitting on a hot job.

The hot metal machines that carry a crucible for the flowing of lead, tin, and antimony are now being joined by a camera in place of a crucible or metal feeder.

These machines are expensive and operate at approximately the same scale. Setting type on a photosetter is a beautiful thing to behold, but when you get all through the author decides to make a few changes, and, as you all know, the job is never done until the paper work is finished. Needless to say, from then on, "COLD TYPE" gets hotter by the moment, and very expensive.

Now! While all this is going on, a couple of guys back at the farm are setting a lot of type on IBM machines (probably boldface No. 2); and a friend is there with a Coxhead machine or Varitype equipment with his neighbor or friend running two other machines called "Justowriters," and the children are playing with the headliner machine developed partly by Lou Livingston, of Truline Studios located in Chicago and Los Angeles.

So, hot type or "COLD" type, they are here to stay. New methods create new business, and new business hot or "COLD" is more business for the typesetter.

BUYER'S CHOICE — HOT OR COLD TYPE

by Seymour Berns
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General Electric Company
Cincinnati, Ohio

This paper presents the advantages and disadvantages of hot and cold type and the basis of choice made by General Electric's production group.

Both processes have advantages and disadvantages. Each serves a definite purpose. A buyer's choice is usally based on past experience. What is a good choice for one buyer might be a poor choice for another. It will be difficult to talk in generalities without using specifics based on experiences. A brief description of G.E.'s production group may help clarify their reasons for selecting hot or cold type.

Personnel:

5 Composers

Equipment:

2 Varitypers
2 Justowriters
2 IBM proportionally spaced typewriters
2 IBM standard spaced typewriters
2 Coxhead liners

This group handles the production work for all contractual military and commercial publications plus any miscellaneous publications which are requested. Almost all cold type composition is done internally. Hot type has to be done externally.

What criteria determines which process will be utilized? Generally they take into account the following basic requirements:

1. Customer specifications: Format — 1 or 2 columns; tabular text, or both; justified or unjustified; hot or cold type style; with illustrations interspersed or separate.
2. Available funds: Is enough money available to do job requested by customer specifications?
3. Size of publication: Is publication too large to be done for the money and time available in accord with specification?
4. Delivery date: If this is not realistic, it must be changed, publication revamped, or else more funds made available for overtime.
5. Periodic revisions: This is important in hot type versus cold type category. Cold type revisions can be costly in time and money.
6. Purpose of publication: IPB, TCTO, O/H, Maintenance, or FLR. This can affect costs (especially IPB's and IPB revisions). Hot typesetters not set up to process IPB. Also cost would be prohibitive.
7. Other general requirements: Good reputation in field for having latest publica-

tions available as soon as possible, giving technical representatives latest coverage. Can affect future business because of poor service. Technical representatives and customer maintenance personnel depend on these publications.

If a typesetting process is not specified, the requirements are evaluated on the basis of the advantages and disadvantages of each process.

Some of the advantages and disadvantages can be easily determined by considering:

1. Quality
2. Typography
3. Flexibility
4. Schedule
5. Cost

Cost requires some discussion. First, costs can be very deceptive. A low original cost can sometimes end up being very expensive when the job is completed. Page for page, hot metal is more expensive. But when all the tangible and intangible aspects of the job are evaluated, it could prove to be no more expensive than cold type, or at least the difference could be narrowed to a point where it would still be advantageous to use hot type instead of cold type. Author's alterations, periodic revisions, vendor service, product support requirements, military service requirements, contractual requirements, and maintenance of company goodwill, these are some of the aspects to evaluate because they can mean money. Approximately 1/3 of G.E.'s publications are done in cold type: all commercial IPC, overhaul and maintenance manuals, and all military parts catalogues. The commercial specifications require it. Parts catalogue production is a specialized field which from a cost and processing point of view eliminates hot type. Hot metal lends itself more to large service, overhaul and maintenance publications requiring periodic revisions, and the tight schedules.

1. Author's Alterations: corrections.
2. Revisions: 90 days.
3. Service: better from hot type vendors.
4. IPB: photo list, panel system.
5. Small publications versus large publications.
6. Staffing own shop:
   1. personnel problems.
   2. equipment investment.
   3. idle down time.
   4. business cycle.
7. Hot type:
   1. extra proofs.
   2. glassines.
   3. uses of above to writers.
8. Proposal work:

HOT	COLD
Quality: Usually good but seems sharper and cleaner than most cold type. Gives best over-all quality.	Usually good; Varitype, Justowriter, and IBM.
Typography: More variations in type styles and more combinations possible. Type faces seem better designed and proportioned.	Varitype offers possibility of using 2 faces at one time. IBM and Justowriter limited to one face only.
Flexibility: Lends itself to periodic changes and AA revisions.	Changes and AA require a great deal of retyping, cutting and splicing, which is time consuming. Panel system or photo list is flexible.

PANEL 8 — ORGANIZING SUCCESSFUL CHAPTER ACTIVITIES

ORGANIZING A PROFESSIONAL GROUP ON CHAPTER LEVEL

by **Waldo D. Boyd**
Head, Technical Manuals
Aerojet-General Corporation
Sacramento, California

The Sacramento Chapter is organizing a professional group to help free lance writers to market their writings. Seven steps were involved in organizing this group:

1. *Somebody had an idea.*
2. *He agreed to talk about it.*
3. *They appointed a committee.*
4. *The committee studied and prepared a report.*
5. *The chapter voted on the resulting motion.*
6. *The chapter took the necessary action.*
7. *Now the interested people are following through.*

You know, most people think that organizations are a waste of time, that a guy is a "joiner" who acts to work with others through a club or society. Some people think that a chapter of STWP has nothing better to do than meet once a month for the express purpose of somebody saying, "I make a motion," and somebody else saying, "I second it!"

The trouble is that sometimes those people are right!

UNIQUE IDEA

In Sacramento, somebody had a most unique idea — perhaps you have heard of it before. Somebody tossed a bombshell into one of our dinner meetings about a year ago, when he said, "You know, there's money in free-lance writing!"

There was silence after he said that. You could not tell if everybody was giving him a treatment, or if everyone was thinking, for real.

Pretty soon, the President saw an opportunity to fill next month's card. He spoke up just in time.

"Well, sir, suppose you tell the chapter about it next meeting? We'll make you the featured speaker."

And do you know what? The guy accepted the challenge!

FREE-LANCING

Now, free-lance wrting isn't exactly new. People have been making a living at it for a good many years. Most of us here, though, exercise our talents through employment, full time, with a company. How can a full time employee, with overtime yet, ever expect to find time for a busman's holiday?

There was almost a 100 per cent turnout at the next meeting. Anyone could see there was keen interest in the subject.

And the audience was not disappointed. Somebody, who had done a bit of writing while others spent their leisure time swimming or moving lawns, told us about the personal satisfaction of having his name in print. Then he mentioned a dozen or more magazines that were crying for new material. Finally, he mentioned there was money involved.

After that, you could not have cleared out that room if you had tried.

PROBLEMS

Now there are some problems that go along with prospecting for gold. Writing for money has its problems too.

A prospector must have a stake. He needs a sack of beans and a pot to cook them in. And he must have a shovel, pick, and sluice pan. And he needs that gleam of gold or silver to beckon him on.

A writer needs incentive, just like the sourdough. Gold is as good an incentive as any I know. I personally think that anybody who writes for nothing has a hole in his head!

Everbody here has a job, probably? . . . that is your sack of beans. You have a typewriter, or can lay your hands on one easily. That is your pick. And just like the sourdough, you hunt . . . and you peck . . . .

MARKETING

One of the real, honest to goodness problems, one that scares people a lot more than writing a piece, is trying to market it.

That is really ironic, too. Here is a little pamphlet put out by *Machine Design* magazine for engineers — "ALL ABOUT ARTICLES." This pamphlet is airmed at *you*! It says right on it, "A guide for authors, . . . WANTED! . . . quick information, not polished writing!"

And it says, "Payments will be made for information and material contributed exclusively to *Machine Design*."

Payments . . . That means money!

So the problem of marketing is really the biggest one of all. Everybody knows a writer can write. And an illustrator can illustrate the piece. How do you get it accepted? And receive pay?

WHERE THE CHAPTER FITS

Now here is where the Sacramento Chapter of STWP got busy. The applause was resounding when the speaker finished, and the questions kept him busy for an hour.

But finally, the president stopped the discussion. He appointed a committee to study free-lance technical writing.

THE STEPS:

Let's enumerate the steps so far, in organizing this professional group on a chapter level:

STEP ONE: Someone came up with an interesting idea.

STEP TWO: He was asked to elaborate on it for the benefit of everyone.

STEP THREE: A committee was appointed to study the idea. The committee had a lot of enthusiasm. It met three times in all, and drafted a whole page of recommendations.

I duplicated a hundred copies of that committee's recommendations, in case this audience is interested in them. They will be lying around somewhere, and you can take one home with you.

WORKING COMMITTEE

Now, we've had an idea; it's been expounded. A committee has met to study it.

In the study, a lot of research must be done. That committee meeting can not be just a tea party, or a cocktail party. It is a working group!

In short, just to give you the honey and not bother you with the gathering right now, the committee recognized that many professional writers, editors, illustrators, and photographers in the Sacramento area were interested in free-lance marketing of technical articles and photographs.

So, the committee recommended to the Sacramento Chapter of STWP that a group be formed. The group was to operate within the framework of the STWP Constitution and Bylaws. It was to be named "The Free-Lance Section of the Sacramento Chapter of STWP."

THE ADVISORY BOARD

It recommended that an advisory board be appointed by the chapter president. The board would consist of not less than three STWP members. This advisory board was to have the job of providing services to section members. These services would be exclusively related to free-lance writing, illustrating, photography, and marketing a finished product.

The committee recommended that membership in the Free-Lance Section should be open to all local chapter members. Those interested would apply in writing to the chapter secretary for listing on the section roster.

The committee recommended that the advisory free-lance board would provide voluntary services to selection members, for example, suggesting three prospective markets for their articles.

And there you have the prospector's most difficult job taken care of. The advisory board would help with the marketing!

STEPS AGAIN

Now we can add Step Four to the list of things that should be done to organize a group on a chapter level:

STEP FOUR: The committee reports, and recommends.

CHAPTER MEETS, HEARS

The chapter membership met one evening a few months ago, and heard the committee recommendations. Enthusiasm was boundless. Everyone wanted to get the free-lance activity underway immediately. But there were still one or two steps left to accomplish.

Somebody had to study the Constitution and Bylaws to see if such a body as the committee recommended, could indeed be set up legally.

Somebody studied. And by the next meeting had a favorable answer.

STEPS AGAIN

STEP FIVE: The motion was made and seconded that the Free-Lance Section be created. The voting was unanimous.

STEP SIX: The president appointed the advisory board.

That is where, in the strict sense, the purpose of this report to you has been served — this is one way to organize a professional group on a chapter level.

But there is just one thing more. And no golfer or bowler worth his salt would be without this one: FOLLOW THROUGH!

STEPS SUMMATED

Now, let me enumerate the steps once more.

ONE: Somebody comes up with a sure-fire idea.

TWO: Naturally, he will be asked to talk about it.

THREE: You can not really do anything without a good, active committee — appoint one!

FOUR: The committee studies all aspects of the idea, and makes formal recommendation to the membership.

FIVE: Make a motion, second it, and vote.

SIX: TAKE the necessary action. And last, but by far the most important of all —

SEVEN: FOLLOW THROUGH! !

CONCLUSION

Now I've given you the step by step, easy-payment method of organizing chapter activities. There is one thing I can not give you. You have to furnish that yourself. You know what it is —

PROFESSIONAL PRIDE!
PROFESSIONAL WORKMANSHIP!
and
SPORTSMANSHIP!

SUCCESSFUL MEMBERSHIP DRIVES

by Joseph Kleinman
Publications Section Head
Sperry Gyroscope Company
Great Neck, New York

This paper describes the membership drive used successfully in the New York Chapter. The operation is divided into three phases — personal contact by committee members, recruiting at meetings, and positive contacts of delinquent members. Geographical divisions and subdivisions of the publications populations aid to provide 10 to 20 prospects for each committeeman in the first and third phases. These committeemen mix at meetings to follow up on an interested prospect.

A chapter, to be successful, must attract and hold members; for without members we can have no chapters, and without chapters we can have no organization. Therefore, the chapter must develop an aggressive program aimed at every potential member and delinquent member in the area. The importance of such a program cannot be stressed too highly.

This paper outlines a program which has been in operation in New York for the past five years. There are three phases to this program — personal contact by committee members, recruiting at meetings, and re-enlisting members who are delinquent in their dues payments.

It is difficult to decide which of the three phases is most important, because there is room for disagreement on this point. My observations indicate that personal contact by committee members is the most important method and provides the greatest returns. The success of this approach requires an active, fairly large committee that is efficiently organized and managed. Therefore, the chairman of the committee becomes the key member of the operation.

The first task confronting a new membership chairman should be a review of his chapter and its subdivision into logical geographic parts. By logical parts, I mean areas having roughly the same publications population. In the New York chapter, we have areas such as Upper Manhattan, Lower Manhattan, and Queens. Each subdivision should then be surveyed and a list made of all companies having publications departments, regardless of size. Using the membership roster, the chairman can then enter the names of all members employed by each company.

To digress for a moment, it becomes immediately apparent that membership lists ought to give the company affiliation when an individual gives his home as the mailing address. It's a big help to know where people work so they can be reached during working hours (this is a hint to our Society Headquarters to provide this information to chapters).

When listing members by companies, it is also advantageous to add the names of nonmembers and the names of the supervisors, especially the top man, whenever these names are available. Having the name of the top man in an organization is very handy when mailing announcements and making contacts for other STWP activities such as Annual Conventions, Contests, and Symposiums. This information can be obtained with the help of the members in the company.

The next step in organizing the committee is to appoint subchairmen. Perhaps it is better to call them cochairmen or area chairmen. Each area chairman becomes responsible for the activity in his area. From the company list the area chairman appoints a committeeman for each company having more than, say, 10 employees eligible for STWP membership. Where the number is less than 10, three to five companies can be grouped so that each committeeman becomes responsible for about 20 prospects. In larger companies, consider more than one committeeman. We in New York have found in our efforts to recruit members that there is a snowballing action in signing up new members. The first member will bring in several more who will bring in their closest associates. This is borne out by the many requests for applications in groups 5, 10, or more, and is the reason a company representative on the committee is so very important. It is like the foot in the door for the itinerant salesman. The company representative is our salesman.

Another great advantage in the committee approach is that this method achieves the maximum personal contact. Thus the pros and cons of membership can be discussed often, at length, and at leisure, and the prospect's questions answered. When the time is ripe, it is easy to push the application across the desk and ask for a signature. A personal request is hard to ignore — it must be answered directly and unequivocally. On the other hand, a mail application is easy to pigeonhole and eventually forget.

But suppose a company has no STWP member? Then the area chairman must try to sign up a member in the company; this member can then become the committeeman. It is also wise to work on the publications supervisors because they often exert a great influence on their employees (indirectly, of course). A really successful area chairman will have very little work to do once he has obtained his committeemen, except follow up.

An important facet of recruiting new members is to use the personal touch. Within one's company, this is no problem, as has been noted previously. To obtain the same results with people at other companies, use the telephone. This method assures that the potential member will be reached, and that he will listen to what is said.

Naturally, not every phone discussion will result in a new member. There must be some sort of follow-up. This is true even where some interest is evoked during a phone conversation, since in the latter instance, an application must be sent. But even when there is no seeming interest, an aggressive membership drive requires a follow-up to the phone contact. This we, in New York, provide by sending the prospect a membership docket. The docket consists of our New York Chapter brochure, a copy of a recent issue of the *Chapter Notes* (our monthly newspaper), an announcement of the next meeting, and an application blank.

Every prospect who has been contacted should be personally invited to several meetings. It is not always feasible to add their names to the formal chapter mailing list, nor is it desirable. Nonmembers should not be maintained on the mailing list because such action places nonmembers on an equal footing with members. If nonmembers get the same benefits as members, there will be little incentive to join. Instead, a separate mailing list for nonmembers should be established. This list should be controlled by the membership committee chairman. An individual's name could be left on the special list for, say, three months. If he has not joined by the end of that period, he should be dropped. You would be surprised how often being dropped from a mailing list can result in first an inquiry and then a request for an application, especially if meetings and publications have been interesting.

The second phase of membership recruiting is carried out at regular membership meetings. There are many reasons for nonmembers attending meetings — interest in subject matter, curiosity in this STWP group, friends attending, free refreshments, or maybe just a need to get out of the house. The reason does not matter; whatever else is done, the nonmember must be made to feel that he is amongst friends, and he must be informed as to the purposes of the society.

Making sure that people become acquainted with each other is a big help. The chapter should appoint a hospitality committee and have its members attend all meetings to introduce people, especially newcomers who might otherwise stand off by themselves. To supplement the hospitality committee's efforts, the chapter can use pocket cards for identification. Our pocket cards contain spaces for name, company, address, phone number, and an inquiry on membership status. We have two colors which we use to identify members and guests. At one time we retained the cards for reuse, but we no longer do so. However, we still collect the cards at each meeting. The membership chairman then reports to the President and the Executive Council on the number of members and guests who attended the meeting. Finally, our membership package is sent to the guests. We are thus assured of reaching more and more people each year, a prerequisite to expanding membership. With the package we include a follow-up letter which is intended to spur their interest.

The membership committee is also enjoined to maintain a table display of the brochure, back issues of the *Chapter Notes*, announcements of interest, and application forms. Some people feel that applications should be used sparingly. Our philosophy is to be generous with them — one new member can pay for printing many hundreds of application forms. Never take a chance of losing a member because an application is unavailable! And certainly never refuse to take money if a prospect wants to join at the meeting. Never suggest that the application be mailed to Society Headquarters. Accept the application and fee, record the name and address on the chapter mailing list, and then send it to Headquarters. This way you can be sure of getting a member.

So far, I have concentrated on obtaining new members. The third phase of membership recruitment actually is maintenance of membership, not recruitment. It is useless to add 50 new members if 49 old ones fail to renew their memberships. This is, in fact, one of the greatest problems a chapter faces. We do not now have answers to the reasons for failure to renew; it may well be desirable to find out, so we can take steps to eliminate the reasons for dropout. The survey is not a valid membership committee activity, and will not be discussed any further. Nevertheless, with or without the survey, I can state very definitely that the dropout problem is a serious one in most chapters. It must be tackled vigorously and continuously.

In many respects, the same tactics used with nonmembers are also applied for delinquent members. In New York, we have found it desirable to contact the member to obtain the reason for dropping out. As I have mentioned, we do not have a complete list of reasons, since we have never conducted a survey on this point; but a few reasons which come to mind are: "I lost my dues notice"; "I'm not getting my mail" (which often can be interpreted to read "I moved and never sent you my forwarding address"); "The meetings are too specialized"; "The meetings are too basic"; and "I don't know. No special reason."

Whatever the reason or lack of reason, a personal contact will often renew interest. If a personal contact is not feasible, try the letter approach. This can be a form letter, although a personal letter from the Chairman or the President is much more effective. Along with the letter, send the latest chapter paper and the next meeting announcement. Ask the individual's friends who are members to contact the delinquent and explain current activities. Be sure to ask the reasons for failure to renew membership. Often the irritations, real or fancied, can be readily removed, and a valuable member regained.

Just a few more points of value to consider in your membership drives. No drive can be successful unless interesting meetings are held which can attract attendance. Although every chapter has its share of members who will never attend a meeting and never intend to, the chapter will soon die if it cannot maintain reasonable attendance at meetings. Therefore, meetings assume an important role in recruiting members. Other activities such as Professional Groups and Symposiums are also important factors in attracting new members.

Expend considerable effort to get supervisors to join and to become active in STWP affairs. This point I have already mentioned, but it is important enough to repeat. The example set by the supervisor will be followed by his employees. A supervisor who is active and who lets his employees know he is active will have many of his people join, even without his exerting pressure. Conversely, a supervisor who is not a member will, by his lack of interest, keep many employees who do not feel strongly about STWP, pro or con, from joining.

In those instances where a supervisor declines to join, at least try to encourage him to post meeting notices, and occasionally send him special documents, the chapter paper or a national publication, so that he can see what the society is doing. Such a campaign is best handled by a committee representative in the same company, another advantage of the area and company subdivision plan.

The ideas I have expressed today are some which we have used successfully in New York. Many other chapters use similar approaches, at least in part; no doubt many chapters have equally effective programs which I have not mentioned. I attempted only to show our system. This program may not be suitable for all chapters, but many of the features certainly can be adapted by some. For our part, we would like to learn of the systems used in other chapters, so we too can improve our membership activities to the end that we may sign up all potential members in our area and that no one will ever resign voluntarily.

CHAPTER PROGRAMMING

by H. C. McDaniel
Director, Technical Information Center
Westinghouse Electric Corporation
Pittsburgh, Pennsylvania

Mr. McDaniel describes some helpful hints for preparing good programs. He classifies programs as: basic — to increase the listener's knowledge of the communication process, and applied — to improve his skill in putting this knowledge to use. He suggests that program committees should be large, providing a good cross section of the membership, and should be helped by a publicity committee.

It seems to me that the logical starting point for these remarks about programming is with a statement of purpose for STWP meetings. I would word such a statement as follows: A series of meetings planned as a contribution to the professional development of persons attending. In general, professional development means the growth of a person engaged in a profession. This can be interpreted to mean advanced training in the knowledge of one's occupation and in the skills needed to use this knowledge. Therefore, if programs are to contribute to the professional development of STWP members, they should be of two distinct types: basic and applied. Basic programs should be planned to increase the members' knowledge of the communication process; applied programs to improve his skill in putting this knowledge to use.

For the purpose of my presentation, I am going to assume that you agree in principle to the purpose for STWP meetings, even though you may not agree with the language used, and move along to the next step in our excursion into chapter programming, that of planning meetings. It seems to me logical and reasonable to say that basic meetings can be a single meeting or a series of meetings devoted to one subject. Whichever plan is used, the subject should be directly related to the body of facts comprising the knowledge necessary to practice in the technical communication occupation. This is the customary lecture-type meeting followed by a question and answer period.

Applied meetings can also be a single meeting or a series of meetings devoted to a single subject. Regardless of plan, the subject should be directly related to the person's occupation. This is the customary audience-participation meeting, which is usually called a work shop.

Where to find speakers for such meetings will always be a problem. However, it does seem that logical sources for speakers for the basic meetings are college professors, publishers, graphic artists, paper manufacturers, plus, perhaps, sound movies. And logical sources for the applied meetings are government agencies, companies specializing in different aspects of communication, technical publishing agencies, college professors, senior members, plus, of course, sound movies.

A next logical step in our excursion into chapter programming is the idea of a theme for each term's programs. For example, isn't it possible that a series of meetings themed to paper: paper for reports, paper for instruction manuals, paper for sales brochures, and so forth, would generate a continuing interest in chapter meetings? I think it is. In addition to paper there are graphics and printing that offer real rewards to the willing explorer and tenacious prospector. The purpose of a theme is to build continuity into programs in the hope that the same kind of interest can be stimulated in STWP meetings that the serialized television soap operas stimulate in the housewife.

It occurs to me that the theme idea can be carried out in either one of two ways: It can be made the principal subject of each meeting in the term, or it can be made an introductory part of each meeting in the term. If the latter, perhaps a 20- to 30-minute sound movie would be the simplest and best answer.

As we proceed on our excursion into chapter programming, sooner or later the matter of a program committee must be dealt with. Although there are as many ideas about how to organize a program committee and what constitutes proper size as there are members in the Society, it is my personal opinion that the larger the committee, all things being equal, the greater the chances are that the programs planned will be more to the liking of the membership. Therefore, I suggest that the membership of the committee be as great in number as there are meetings scheduled in the term. For example, eight scheduled meetings would call for an eight-member committee plus chairman. I'm also going to suggest that the program chairman be sure his committee membership is a good and valid cross section of the chapter membership. This ensures the viewpoint of the different interests in the membership on the program committee.

Here is why I'm suggesting a large program committee: First, eight people can generate more ideas than four, and ideas are what programs are made of; second, each committee member can be placed in charge of a single meeting, and the competitive spirit being what it is, think if you will what this will do to interest and enthusiasm; and third, the more members we can interest in participating in the chapter's activities, the stronger the chapter.

A significant aspect of chapter programming is publicity. Therefore, let us talk about this for a bit. First and foremost, do not expect the program committee to handle this aspect of programming unless there happens to be a member of the committee who is skilled in public relations. Rather, this should be handled by someone who has an intimate knowledge of and acquaintanceship with the local newspapers, television, and radio stations, plus the specialized skill needed to write a good news release. A good story, properly distributed, is the aim here, and the only person who can do this is a professional in public relations. Let him worry about distribution and release dates for the stories.

In addition to coverage in the public press, the chapter newsletter should tell the members about upcoming meetings. And if there is an engineering association or similar association bulletin, such as the Pittsburgh Technicalendar — a monthly bulletin that lists the meeting date, subject, location, and time for 35 technical groups including STWP, and that is mailed to 15,000 members of these 35 affiliated technical societies — make certain that STWP meeting notices reach the editor on time.

Another device that can be used for jogging memories is the postal card reminder notice. Since we are all busier these days than we like to be, a reminder of an upcoming meeting is generally appreciated. A last minute reminder can be made by telephone. If the chain telephone call procedure can be set up in your chapter, it is a wonderful instrument to use, because the member can be more strongly urged to attend by telephone than he can by newsletter or postal card announcement.

And finally, there is the term meeting calendar. This requires of the program committee early planning and early decisions. If the committee can agree upon subject and date in advance of the first meeting in the term, a calendar of meetings can be published and mailed to every member of the chapter. If this is done, the members should be encouraged to enter the STWP meeting dates on their personal appointment calendars. If they will do this, they will be reminded almost daily of the next STWP meeting.

I am sure there are among you persons who will not agree with everything I have said. To each of you I make this suggestion: Do not let your disagreement with me blind you to such extent that you do not think through the suggestions I have made with the idea of adapting or modifying them to fit your particular condition or situation. If you will do this, I am sure you will be able to take home with you an idea that can be put to work.

So much for generalities. Now then, I would like to get specific and direct your attention to the reports about chapter programming that were sent to me in reply to my invitation to do so. I think you will find these of great interest.

The first report comes from Gertrude Taylor Smith, chairman of the host chapter for this convention — the Golden Gate Chapter. Miss Smith came through with a report on their programming activities that is just as well organized and complete as are the arrangement details for the convention. Because it is such a good report, I am reproducing it in full.

> The meetings this year have had a consistently high attendance — higher than ever before. The chapter is a year older and that is one reason, but the increase seems to be due to what the chapter is offering in its program and in other respects.
>
> A brief rundown of the program will give you an idea of what we have been doing.
>
> March, 1960 Business meeting. Present officers took over.
>
> April, 1960 "Simple Demonstrations of the Fundamentals of Computer Operation" — Dr. Douglas C. Englebart, Stanford Research Institute.
>
> May, 1960 "Philosophy of Correct Usage of Punctuation and the Relative Clause" — Frank C. Calkins, Geologist and Technical Reports Editor, U. S. Geological Survey, Menlo Park.
>
> June, 1960 "Present-day Problems in Technical Publishing" — Art Inman, Program Chairman, was Discussion Leader.
>
> July, 1960 "Adventures in Science Writing" — Dr. Milton Silverman, Science Writer, San Francisco Chronicle.
>
> August, 1960 No meeting.
>
> September, 1960 "The Profession of Technical Writing: Prerequisites to the Establishment of an Academic Program" — Prof. Clifford F. Weigle, Assistant Head, Department of Communication, Stanford University.
>
> October, 1960 "Preparation of Technical Proposals as Seen by Military Sales Department" — Frank C. Mansur, Manager, Research and Equipment Sales, Lockheed.
>
> December, 1960 "Cadence and Punctuation" — Frank C. Calkins, U. S. Geological Survey, returned by popular request.
>
> January, 1961 "Visual Presentation of Proposals, Reports and Brochures" — Christopher Coughlin, Hobco, Beverly Hills.
> "Ten Years of Commercial Art" — Richard Coyne, Editor and Art Director, CA, Journal of Commercial Art.
>
> February, 1961 "STWP's Activities at the National Level" — a report by Dr. Vernon M. Root, National President.
>
> March, 1961 Outstanding technical film produced by Esso, Ltd. in Britain to be shown.
>
> April, 1961 Dr. Robert C. Miller, Director, California Academy of Sciences, will speak on Jargon.
>
> May, 1961 Exhibit and Award Presentation — First Annual Review of Technical Literature in the Bay Area.
>
> June, 1961 A new set of officers will take over.
>
> Our members this year come for the social aspects of the meeting, the drink at the bar before the meeting, to see and talk to other similarly engaged, and to hear a good speaker or see a good film. They are for the most part pretty well established in their jobs, mature, older, and not interested in tutorial meetings.
>
> Because of the composition of our membership, there is not too much interest in meetings devoted to military problems, as was the case in Los Angeles where as a founding member of TPS I watched and participated in a very different type of program.

And Miss Smith brings her letter to a close with this statement:

> One problem is how to get the artists and illustrators to come to meetings other than those devoted to art.

The next report is from Joe Godfrey, chairman of the Mid-Hudson Chapter program committee, who came through with the following report on his chapter's activities for the 1960-1961 term. It is so well done that I have reproduced it verbatim:

> Our prime concern is to interest and bring out a good presentation of our membership to each meeting. This is a difficult job, as our membership is en-

gaged in many phases of writing. I might say that we have been successful in our efforts. Our membership averages from 50 to 60 members. We draw between 40 to 50 at most meetings.

We have seven meetings each year between late September and early June. Each meeting features a guest speaker; the last meeting is also the annual business and election meeting. My program committee has five members of whom two, including myself, do most of the work.

In setting up criteria for our guest speakers, we take many things into consideration. Following are some of the items we consider.

1. The subject must be of interest and value to most of the people in the chapter, though they are engaged in various phases of technical writing.
2. The speaker must be an "expert" from at least 50 miles away.
3. The speaker or his affiliation must be known and respected by the members.
4. The subject at each meeting must be different from all other subjects during the year, but the subject must deal with and be of value to those attending.
5. We have free coffee and doughnuts after the meeting for informal chatting and introductions.
6. We precede each meeting with a dinner for those who care to attend.
7. We find work shops unsuccessful at this chapter (at least up until now).
8. We attempt to have one or two of our meetings as joint meetings with other professional societies or other chapters of STWP.

I will give you an idea of our programs for the 1960-1961 season.

October, 1960 We had the manager of movie production from IBM headquarters in White Plains, New York, who spoke on how the written word can be misinterpreted.

November, 1960 Our speaker was from a large advertising agency in New York City. He spoke on "Technical Writing in Advertising."

January, 1961 We had a speaker from a large printing firm in Albany, New York. His subject was "When to Use Letterpress or Offset."

February, 1961 The speaker is editor of a national magazine published by one of the largest publishing houses in New York City. His subject was "Better Writing for Publication." This was a joint meeting with IRE.

March, 1961 (Not yet held.) Our speaker will be an economic analyst and commentator for the Voice of America. His subject will be "Better Foreign Relations Through Technical Writing."

May, 1961 Joint meeting with Mohawk Chapter. The speaker has not been confirmed at this time.

June, 1961 Annual business and election meeting. The speaker has not been confirmed at this time.

The third report is from Mrs. Elizabeth S. Kolpack, chairman of the Chicago Chapter, and Don W. Palmer, chairman of the program committee. Each wrote a long letter about their program problems. The following rather full report is taken from their two fine letters.

The Chicago Chapter membership is highly diversified: electronics, chemical, mechanical, and heavy industry — with electronics predominating. Only a comparatively few members are engaged in writing government material.

We have found tours quite successful: R. R. Donnelly, American Typesetting, Chicago Sun-Times. Our members have little interest in programs on writing, and as a result, the turnout is usually poor.

We would like to know how to improve feedback from our members. In June, 1960 we asked them for ideas about programs. The response was fairly good, and some of the suggestions resulted in programs we would not otherwise have had. This feedback encouraged us to prepare a multiple-choice questionnaire that we hope will give us a better cross section of members' ideas on programming than we obtained from our June, 1960 request.

Here is a summary of the six meetings held this term:

October, 1960 The speaker was a professor of physics from Illinois Institute of Technology. He spoke on "Exchanging Information by Use of Interlingua." Turnout and interest level were both low.

November, 1960 Our speakers were the chapter chairman and vice-chairman. They talked on "Some Technical Aspects of Publishing, or the Art of Printing a Technical Manuscript." Turnout was somewhere between medium and high, but there was no doubt about the interest level —it was very high.

December, 1960 We had as our speaker a man from Commonwealth Edison Company, Chicago. He told about the problem of training men to operate their Dresden Nuclear Power Station which is some 50 miles from Chicago. Turnout was very good and the interest level in the subject equalled the turnout.

January, 1961 The speaker was from the firm of Kottcamp and Young, Training and Education Consultants, Chicago. The subject of his remarks, "Writing for the Multiple Offense," is not too descriptive of the subject matter of his remarks, as he talked about the need for a clear-cut objective and an understanding of the reader. To these two well-known basic elements of writing he added a third one: need of the reader to understand the writer. Turnout and interest level were both about medium.

February, 1961 Our speaker was from Science Research Associates, Inc., Chicago. Her subject, "Psychological Tests and the Technical Writer," was concerned with the use of such tests to assess both the abilities and the personality traits of technical writers. The turnout was only medium, but the interest level of those present was high.

March, 1961 We had as our speakers two men from the Admiral Corporation, Chicago. Their subject: "Military Specifications and Technical Communications." The turnout for this meeting was poor, but the content and presentation were above average. Interest level matched turnout.

The fourth and final report is from Dr. Hunter P. McCartney, president of the Delaware Valley Chapter, who sums up their philosophy about programming in three short paragraphs. I think you will find their attitude of interest.

> In the Delaware Valley Chapter meeting program, our scheduling has been based on the philosophy that the entire spectrum of technical communications should be dealt with. In fulfilling this philosophy, we have tried to schedule speakers whose primary concern is with technical matters, alternating with speakers whose primary interests lie in the field of communications as such.
>
> For example, our most recent speaker dealt with the subject of languages used in the computer industry. The speaker before him dealt with folk languages. So you can see that we try to avoid the nuts and bolts approach so often found in meetings of our societies. We feel that the members get enough of that kind of activity during their working hours; hence, we spend much of our meeting time on peripheral areas aimed at developing the large framework in which the member is to do his work.
>
> So far, we have found this approach to be an attractive one — judging by the enthusiastic comments and by a large increase in members attending our meetings.

I began these remarks by expressing the hope that you would find in them something useful and helpful. I hope I have not let you down.

LUNCHEON ADDRESS

APRIL 14, 1961

TECHNICAL WRITING IN EUROPE

by W. Earl Britton
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Educational institutions, industries, and publication and research establishments in England and the Continent are surveyed in depth by Professor Earl Britton. One of the conclusions he reaches is that technical communication problems abroad are as severe there as they are here but that historically we have an edge in coping with them.

I have just returned from one of the most exciting experiences of my life. We sailed from New York last September 2, landed in Rotterdam on the tenth, hurried over to Wolfsburg to pick up the car we had ordered in Germany, and then set out on a grand tour of ten European countries. We traveled 7,000 miles in two and one half months on the Continent and 2,000 miles in two months in England. We had a wonderful time. What impressed me deeply was the courtesy and goodwill of the people we met everywhere. In three different instances, strangers got into their cars and drove all the way across cities in order to guide us, because it was simpler to show us than to tell us. We were treated so cordially and with such kindness that sometimes I wish we could do without governments, since people, left to themselves, do so well together.

In the course of this survey, which I conducted during a sabbatical leave from my teaching post, I called on about fifty organizations in order to learn what was happening in the field of technical writing. For their part in paving the way for these interviews, I want to thank publicly the Dow Chemical Company, General Motors Corporation, and Westinghouse, particularly H.C. McDaniel, our own Vice-President, who went to great trouble to open doors for me all over Europe. Really, the stack of mail he sent out must have accounted for a noticeable item in the Westinghouse budget for the past year.

You might ask, "In going into so many countries, did you encounter language problems?" Only occasionally. In the little town of Dinkelsbuhl, which still retains many of its medieval aspects, I could not break through with my weak German to learn the "check out" time at our inn. Evidently there was no such conception in the thinking of our host. When finally I put it this way, "What time must we leave?" he replied, "Oh, any time," and that was the best we could do. In a small town in Sweden the only restaurant open one Sunday morning was a conditori. If you have eaten in such places, you may be accustomed to their food, but I was not interested in open fish sandwiches for breakfast. We tried to communicate our wishes but without success. Various customers in the place tried to assist, only to complicate the situation further. Finally, the resourceful manager beckoned me into the kitchen, called up a friend in town who spoke a little English, and had me explain to the friend just what I wanted. Then the friend explained my order to the manager, and, sure enough, we soon had a fine serving of bacon and eggs. (I can't help observing that the most serious deficiency I found in central Europe was ignorance of a proper breakfast. A hard roll and a bit of marmalade just cannot serve as the foundation for a good life.)

On the whole, English was spoken pretty generally except in France. Not that it isn't spoken there, but I think the French are inclined to resist English because of national pride. The only interviews in which I had to depend upon interpreters were in Paris. At the Renault Plant about five of us worked through an interpreter. If you have ever done this, you know how amusing it can be because of the delayed responses. One side laughs, there's a pause while the translation is made, and then the other side laughs. The other instance in which English would not do also was in Paris, and I cite this as an additional example of the kindness and generosity of the people we met. Mr. Camera of the Westinghouse Office referred me to Mr. Breguet, a friend of his, and an official in the family concern, the Breguet Aviation Company. I went out to call on Mr. Breguet, who, as a side line, runs a small electronics plant which he bought at a bankrupt sale and is nursing back to health. He was most cordial, summoned two of his engineers to the office, and we had a very pleasant session. He also offered to put me in touch with the Breguet School, a scientific institution named for Mr. Breguet's father and grandfather. When I got back to my hotel, he called to give me the time of the appointment and to explain that since the President of the school spoke no English an interpreter would be provided. The next day, when I walked into the President's office, there sat Mr. Breguet's lovely young secretary, whom he had sent all the way across Paris to interpret for us. And this sort of thing happened again and again in the course of our travels.

The extent to which English has become a major language all over Europe is evident in an experience I had in Holland. The National Research Organization, known as NTO, has a branch at the Technical University of Delft. When I called there, one of the officials remarked, "By the way, you might like to visit a class that is beginning in a few minutes." So up I went and found an instructor and fourteen chemists, physicists, and engineers sitting around a table speaking English. And that is all they were doing. Despite the fact that the instructor had a British, in fact, an Oxford accent, the exercise was still a very useful thing. The point of it all was to equip these men to take part in international conferences, which are usually conducted in English. Well, I have taken much longer than I intended for this introduction.

It is significant, I believe, that this survey was supported by a research grant from the University of Michigan, especially since the grant had to be approved by the Literary College rather than the College of Engineering. This recognition of the field of technical writing by the humanities may well indicate what is gradually developing in higher education, further evidence of which is the fact that two of our candidates for PhD's in English are conducting research in this field.

In my application for the sabbatical and the grant, I pointed out that I intended to visit Europe and survey the field in search of methods, procedures, and attitudes that could be brought back and employed in the improvement of our own technical writing. As a teacher I was interested in this kind of thing, particularly since I was in a position to assist in transmitting such information.

I set out on this assumption: generally speaking, European education, especially in the realm of fundamentals, is superior to ours. In turn, I drew the conclusion that their technical writing should also surpass ours. I found evidence everywhere for the validity of the assumption. But I think I was wrong in drawing my conclusion from that assumption.

Here I should note that I am not an authority in this matter. The study yielded impressions, not scientific facts. I am bringing you, then, personal reactions to what I encountered. Fifty interviews are hardly enough to assure that there are no exceptions to my findings. I tried to compensate for this limitation, however, by inquiring of all I met in this field, "Can you tell me of any activity in the way of courses, training sessions, societies, or publications concerned with technical writing?" On the Continent the answer usually was, "There is nothing, as far as we know."

I should also note that I quickly learned the necessity of defining technical writing, which, to many of those I encountered, signified principally technological terminology. Interest always increased as soon as I remarked that I was concerned with the molding of technical material into the proper form or structure for purposes of clear communication. It was in this area, of course, that most of the difficulties I learned of were occurring.

As Mr. Lacy just said (I was going to say this but he got ahead of me), he is impressed by the fact that we in America have all of the problems England has. In other words, England and the Continent are confronted by the same difficulties in technical writing that disturb us.

In their efforts to solve these difficulties, the Continental countries are behind America. Quantitatively we are also ahead of England, though I should not want to compare the quality of the two. But the most pronounced impression I brought back was that a fine, basic education, even when it includes majoring in a language, does not necessarily produce good technical writing. I cannot prove this, but all the evidence I could gather pointed to this conclusion. Personally, I don't like it because I prefer to think that a sound, fundamental education in the humanities will produce good technical writers; but somehow this doesn't seem to happen.

That is my general view. Now I want to put a little meat on some of these bones. Let me first document the state of affairs that I found. The fifty organizations I visited can be classified into three groups: educational institutions, industries, and publication and research establishments. The complaints advanced by educational institutions were pretty consistent everywhere I went, whether Italy, Germany, or the northern countries. Dr. Max Kneissl, head of the Geodetics Institute of the Munich Technische Hochschule (an expression I shall hereafter interpret as Technical University, since we have no English equivalent), frankly admitted that many of their engineering students were poor writers. He showed me a set of reports in which he was blue penciling bad grammar, even. I was naturally surprised because of the reputation of German education for fundamental and disciplined training. Dr. A. Guyer, internationally famous chemist and engineer at the Technical University in Zurich, declared that the writing of their students had become so unsatisfactory that rather drastic measures had had to be adopted, despite the fine schools from which the men had come. The Rector of the Royal Technical College in Copenhagen admitted that he was puzzled by the inability of many of their students to write competently. "We don't understand it," he went on. "They have had splendid courses in excellent schools, but they cannot write adequately." An officer in the Royal Institute of Stockholm said much the same thing. The Technical University of Delft, which seemed to resemble our scientific schools more than any other I saw, is bothered by a similar situation. The latest recommendation by their Board of Visitors is that greater attention be given the writing of technical reports. All this naturally made me feel very much at home.

What of industry? There the same complaints prevail. The head of the Technical Information Service of the British Petroleum Industry declared: "We rarely encounter an engineer just out of school who can write." The heads of Technical Information at the Volkswagen works, the Fiat Company in Italy, the Volvo Company in Sweden, and the Vauxhall Company in England all testified in varying degrees to the same thing: "Our engineers cannot write," by which they meant, "They cannot communicate." Mr. Lonkhuyzen of the famous Philips plant in Eindhoven, Holland, reported that even language majors right out of Dutch universities were not satisfactory as technical writers. The company had finally decided that it must train its own people for this work. The head of Technical Information at the Siemens plant in Erlangen, Germany, complained of the heavy dependence of engineers upon their private terminology. "I am an electrical engineer," he explained, "but they write stuff that I cannot understand."

In many of these conferences I ran into the familiar practice of using wives as test readers. Each reporter thought that his company was unique in this practice. (I was delighted by many instances of this unfamiliarity with customs abroad. A lad in Germany was much impressed to hear that we had Coca Cola in the States. And in London — I don't know what Mr. Lacey will think of this — I happened to mention to a young man who was waiting on me in a photographic shop that I had purchased in San Diego at Woolworth's an English light meter that was not yet available in England. "Oh, do you have Woolworth's over there?" was his surprising reply.) But wives have been superseded by another kind of test reader in at least one American concern. One of the Boeing test engineers who attended our Technical Writing Institute in Ann Arbor the other year told us of testing their reports on wives but also on morticians. I was immediately fascinated by the impression that might be made by an ad reading: "Wanted: Morticians for part-time employment. Apply to Boeing Aircraft Company."

The publications and research organizations in Europe are particularly aware of the problems of technical communication. Mr. Adolf Obst of the *Overseas Post* said that he frequently had to assign a writer and a scientist to the same project in order to procure a suitable article. Mr. Giebelhausen, editor of *Grossbildtechnik* at the great Linhof works in Munich, declared that his greatest need was men who combined technical knowledge and communicative ability. The Christian Michelsen Institute in Bergen, Norway, reports the same difficulty, despite the fact that its personnel is largely outstanding scientists and PhD's. The British Iron and Steel Research Association, known as BISRA, and the National Physics Laboratory of Britain are troubled by the fact that often an engineer will miss the point of the matter he is reporting. That would be difficult to believe had I not encountered the same situation in many of my students' papers. I suppose it happens because the engineer feels that the point is so obvious that it need not be put.

Now before asking what is being done to correct this over-all situation, let me describe some matters that impede change. The first is the educational philosophy that pervades Europe: namely, that education should be broad and basic rather than particularized. The head of a large rubber company that I visited along Champs Elysees was amused to learn that there were people like myself who were interested in technical writing as a specialty and taught courses in the subject in schools. At the Paris opera we sat next to a lad who, hearing us speak English, broke in to say that as a high school student he had spent a year in a San Diego school on an exchange program. He returned to France with great admiration for the United States but is still amazed at our school system because its curricula are not basic. Such a philosophy makes any sort of change difficult, even when it is desirable. Moreover, the fact that the schools are controlled by the state also discourages change. At the college level, of course, the old complaint of "not enough time" was heard everywhere. Their technical education programs are just as badly jammed as ours. Not only is there no time, but also there are no qualified teachers of technical and scientific writing.

A second block to change is certain cultural traits. For one thing, Europeans, as we know, are more tolerant of and patient with inadequacy than are Americans. We are not only impatient, but also we are optimistic enough, however naively, to believe that we can change and improve. I don't believe that Europe is this way. One finds there little haste to alter what has become customary. Another cultural trait is the Continental respect for the expert and the professor. They occupy an exalted status and in many instances feel no obligation to write down or be communicative to their audience. An observant engineer can easily conclude from this situation that to be clear is really unprofessional. On this score, B. C. Brookes, of the University of London, recently did an interesting study of the styles of some outstanding scientists and engineers whose works had been published. On the basis of a readability index which he devised and applied to these works, he plotted the writers' comprehensibility against time. During their rise to fame, and until they became full professors or Fellows of the Royal Society, their writing became increasingly difficult to understand for the very simple reason that they were writing to impress their readers with their learning. But once they had arrived, their style changed. The curve sloped downward, for now they wrote sensible, communicative, relaxed English. The last cultural trait I shall mention is the historical orientation of mind. I encountered it on the Continent as well as in England. One of my old students in Zurich said that he cannot use a Swiss engineer on certain kinds of problems because by the time he has sketched in all the relevant background material, the problem will have ceased to be or will have had to be disposed of on whatever other basis is available. The English view or tradition is much the same. They like to begin at the beginning of a subject; it is sensible and the approach is leisurely. That is why the European editor of *Control Engineering* has had to recast most of the articles that have come to him from British engineers and scientists. The point of the articles is usually buried somewhere well along in the document instead of being brought up into the front. Though this editor is a native of England and a graduate of an English engineering school, he has been won over to our way of thinking by his eight years of experience with the McGraw Hill Company. But some Englishmen object to this way. An official of Westinghouse Brake and Signal Company in London admitted his dislike of this approach. "I don't want to be hit in the face with the point of an article the moment I begin to read," he said. "I want to be led into the subject gradually, and assisted with ample background matter." Naturally, I asked how he could know the relevance of this matter if he did not know where the article was going.

So much for conditions in Europe and the elements that discourage change. Now I want to describe some of the things that are occurring in our field. Very little is going on on the Continent. France very likely does not believe that technical writing is a problem. And there may be some reason in their view. The French have a fine sense of language. They are clear writers and they do things systematically. (Their subway system is a model, and easily negotiated even by a stranger. And they queue up, which makes me wish I had time to discuss queues in Italy, France, and England, because of their bearing on national traits. In Paris you have seen the little machines on utility poles from which you take a number that assures you priority in boarding the next bus.) But I shouldn't ignore the remark of one professor at the Breguet school to the effect that better technical writing was needed in France, but that the economy of the country was too small to afford such specialization. He was something of a heretic.

Italy recognizes the problem, particularly in the large industries, but cannot do anything about the matter yet. In Switzerland, the need is felt, and informal efforts are being made to improve conditions. At the Technical University of Zurich which I mentioned earlier, every professor, regardless of his specialty, has had to become a teacher of technical reporting. This is good, provided, of course, they have the time and the skill. I was told of a course in technical writing being taught in Berlin but could not go there to investigate. Munich's Technical University is requiring all students to prepare a number of acceptable reports in order to graduate, but no formal course is offered. The Siemens company provides no formal training, but does require its engineers to prepare customer material in language an intelligent layman can understand; when technical terms are indispensable, at least they must be kept to a minimum. (The Siemens company, like many others on the Continent, is troubled by the differences between American and British English. It is a large problem and I wish that I had time to discuss it at length. Some companies go one way, others another. The Renault company issues a motor manual in British English for their English customers and another in American English for us. The Volkswagen company, on the other hand, issues only one English version. And that has been translated evidently by an Englishman because one statement in the manual of my own VW reads, "Do not remove this cap whilst the motor is running." Siemens, incidentally, uses American English, South American Spanish, and Brazilean Portuguese in their customer material.) In Scandinavia I heard of only one course in technical writing, an informal one at the Michelsen Institute in Bergen. But Holland offers a number of these — at the Technical University of Delft, at the Shell Laboratories in Amsterdam, and at the Philips plant in Eindhoven. At Philips, the course is part of a two-year, in-service training program to produce technical writers for various branches of the company. Holland's leadership on the Continent is further evident in a meeting held at Eindhoven last December 6th. Nearly eighty representatives from all over Holland gathered to hear Professor Reginald Kapp, who flew over from London for the meeting, and to establish a Dutch branch of the British Society, The Presentation of Technical Information Group.

But the real leader abroad is England, and that position can be attributed in large measure to Reginald Kapp, the patriarch in our field. One of the most delightful features of my trip was becoming acquainted with this grand man, with whom I was fortunate enough to have many associations both social and professional. He is 74 now; and though still active as a consulting engineer and though still writing books, he has retired from his post as Dean of the Engineering Faculty in University College, University of London. But he did not leave before appointing B. C. Brookes to carry on instruction in technical writing at the College. Brookes is an outstanding man in this field, and we want to bring him to Michigan before long, in which case I hope that he can address this Society. Professor Kapp's lectures at the College some years ago resulted in his little book *The Presentation of Technical Information*, and the founding of a society by that name, but usually referred to as PTI. It meets once a month, from about six until seven-thirty — a suggestion for our chapters, incidentally, since it enables the members to come directly from their offices and yet not lose an evening at home. I attended a very pleasant meeting at the University, where they always gather, and was permitted to tell them something about our own STWP. But you would never guess the subject of the main address of the evening. We had (and this is the true English spirit — the spirit of the amateur) Mr. Cotton, Ballet Critic of the London *Telegraph*, who addressed us on ballet. That the assemblage of technical writers delighted in the subject was evident in the lively discussion that ensued. PTI is a fairly academic group concerned with rather basic investigations in the field of technical writing. Another group, The Technical Publications Association, known as TPA, is more vocational. Working with the City and Guilds of London Institute, it helps plan courses, set examinations, and provide certification of technical writers in what appears to be an interesting effort to establish some sort of professional standing in the field. Members of TPA must be actual writers or otherwise engaged in publication activities.

In addition to these societies — PTI, incidentally has a branch in the Midlands as well as in Holland — there are courses in technical writing throughout England, many of them in industries, some in the newer scientific schools, and one at the University of London. There are consultants and competent teachers. There are even technical writing and publications establishments that will contract, like their counterparts here in the States, to produce technical manuals and other similar materials.

I said earlier that we are quantitatively ahead of Europe and even of England in technical writing activity. Let me conclude by observing that I do not think we can take any special credit for this position. We simply felt the need first. We were the first to feel the impact of tremendous government research and development programs in new areas like electronics and missiles, and to discover in consequence the inadequacy of our written communications. We had to move rapidly to meet this situation, with the resulting widespread interest in technical writing that began in the forties. Other countries only now are approaching or have recently arrived at this stage. This interpretation is borne out by the experience of the Michelsen Institute. For years it devoted its activity to pure research and issued its formal papers. There were no difficulties. Then they undertook to carry out some contract research for government and industry and immediately trouble began. For the first time there was a measure of their communications, and they were faulty. Their clients were not understanding their reports, though prepared by highly competent scientists. Today, the Institute gives considerable attention to the preparation of reports that will be the utmost in clarity. So Professor Kapp must have been right when he said, in response to my inquiry about the ability of pure scientists to write well, "Oh, they are just as bad as the engineers; they just don't know it."

PANEL 9 — MANAGEMENT INSIGHT INTO YOUR PUBLICATIONS FUTURE

DISMISS OR PROMOTE — A DECISION MATRIX

by **Allan Lytel**
Director of Publications
Avco Corporation
Cincinnati, Ohio

This paper considers nine factors which a manager must weigh in evaluating the probable value of an individual contributor's work: job knowledge, formal education, nonformal education, work control, salary scale, interfaces (other people in the same and related jobs), growth potential, job route, and work approach.

INTRODUCTION

The problem of dismissal or promotion of an individual is a complex question. One of the most important facets of technical writing management is the ability to train and develop the people who are required for a broad publications effort. This paper is an attempt to consider some of the factors which a manager must weigh in evaluating the probable value of an individual contributor's work. These remarks apply to a technical writer or editor in a nonsupervisory role. For brevity such a person is referred to as a writer.

There are probably nine areas which should be considered in weighing the potential contribution an individual can make to a technical publications effort. These are outlined below:

1. Job knowledge
   a. Own job
   b. Related jobs
   c. All graphics
2. Formal education
   a. Science
   b. Journalism
   c. Level
   d. Depth
3. Nonformal education
   a. Publication
   b. Motivation
   c. Feedback
   d. Other approaches
4. Work control
   a. Time scheduling
   b. Budgeting
5. Salary scale
   a. History
   b. Potential
6. Interfaces
   a. Others in the same job
   b. Others in related jobs
   c. Customer
   d. Management
   e. Vendors
7. Growth potential
   a. Individual
   b. Supervisory
8. Job route
   a. Desire
   b. Training
   c. Accident
9. Work approach
   a. Depth
   b. Breadth

Management of technical publications must remember in making value judgments that there is the need for sound knowledge and experience in writing, editing, and the graphic arts plus a grasp of budgetary problems and at least a rudimentary understanding of costs and accounting methods for a potential supervisor. Also on the surface the five general types of publications seem quite diverse. They include the following: engineering data which covers instruction books, parts lists, and reports; material for open publication such as scientific papers, magazine articles, and books; marketing material in the areas of proposals and brochures; and the large group of advertising and sales promotion publications such as news releases, ghost-written speeches, and handouts for conventions or meetings.

But a qualified supervisor or manager can pull these together for, while there are these many forms of publications each with its special demands, the skills required of the various technical writers have much in common. As one writer says:

> "Essentially, the talents required for success in any one type of technical writing are much the same, the differences between the types of writing already named being a matter of which skills are enphasized for each type.
>
> "In handbook writing, for example, organizational, scientific, and journalistic training vie in importance; knowledge of psychology is of lesser importance. In task analysis writing, however, skill in psychology is paramount. In report writing, the techniques of journalism and English are particularly important. But in brochure writing, the emphasis is shared more or less equally by psychology and journalism.
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> "Obviously, the degree of competence in science, mechanics, organizational ability and psychology required for any one type of technical writing varies with the type of equipment being written about. However, competence in the basic skills of journalism and English must be considerable in all types of technical writing about all types of equipment. Clarity of expression and reportorial skill are needed, independent of the dictates of the type of equipment being discussed or the type of writing being done.
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> "Training in journalism becomes particularly important for writers who, in addition to writing copy, are expected to perform the other tasks involved in laying out and publishing a document."[1]

The Publication Manager must review his people and determine their future in the organization. Most managers who lead rather than drive find that the spirit of a review is fully as important as the actual salary increase. Perhaps Murray Lincoln put it best in his book *Vice President in Charge of Revolution*:

> "I used to think that once I had charge of an institution I could make it do anything I wanted it to do. But after an organization grows to a certain size it has a life of its own and you can't make it do much of anything, however much power you have to hire and fire. You must work constantly through education, persuasion, and demonstration to get your own people to do what you think ought to be done."

As the manager guides and leads he periodically discusses each writer and tries to measure him by an objective standard. The manager faces the writer and draws up a balance sheet.

JOB KNOWLEDGE

Management is primarily concerned with measuring and evaluating the contribution of a writer in the field of technical publications. Very probably the most important single factor is his knowledge of the job.

In some business training courses students are told that the first step in a business effort is to determine the type of business that they are in. Any reasonable consideration of publications shows that this is a service business in which the writer is selling his services. He is really selling his ability to write, his knowledge of editing (if he is a writer-editor), or his grasp of the graphic arts. He is selling his service in communications. This is really his job. Whether he is preparing a technical order, a brochure, or a proposal, his fundamental job as a service is to prepare a form of written communications. As part of a service organization his customer relations is a significant part of his job.

A writer should be concerned with the ultimate finished product which is the completed publica-

[1]Porcasi, Paul, "Teaching the Skills of Technical Writing," *U.C.L.A. California Sun, Vol.* 10, No. 25-A (July 1959) p. 7.

tion, within covers, ready to do its job. He must understand graphic arts and know how to use the many available techniques. Of course, it is not always possible for the writer to choose among the various possibilities, but he should know the art techniques, photographic problems, and the available methods of printing.

The writer must have, as a first measure of his value in his job, a thorough and complete understanding of what his job is, how it relates to other publications jobs, and ultimately how his work affects the final completed publication.

While there are many different job titles there is some uniformity among the several viewpoints of writing. One of the clearest statements of the job of the technical writer resulted from the work at Fordham University.[2]

The results of this study of leaders in the field of technical writing produced a list of nine items or elements of the writer's job. These elements are:

1. Estimating
   - Obtain data for estimate
   - Analyze specifications and format
   - Prepare proposals
2. Organizing the Job
   - Establish methods and procedures
   - Schedule work
   - Plan production
3. Researching
   - Technical check on source material
   - Test to develop data
4. Preparing the Manuscript
   - Organize text
   - Write
   - Plan illustrations
   - Direct preparation of art and photography
   - Evaluate reviewer's comments
5. Editing, Technical
   - Inspect text and art
   - Check final copy
6. Editing, Copy
   - Literary edit
7. Proofreading
8. Layout
9. Supervision

Of all of these the heart of the writer's task is the written word. Technical writing is good writing. As a teacher of technical writing, Dr. Morris Freedman, put it:

> "Technical writing calls for the same kind of attention and must be judged by the same standards as any other kind of writing: indeed, it calls for a greater attention and for higher standards. And I say this as a former science and medical writer for the popular press; as a former writer of procedure manuals and directives for the government, as a former editor of technical studies in sociology, statistics, law, and psychology; as a former general magazine editor; as a writer of fiction, essays, and scholarly articles; and, not least, as a professor of English. We can see at once why technical writing must be measured by higher standards, or, at least, by different ones, if anyone will not grant me that they are higher. Technical writing is so immediately functional. Confusing directions accompanying an essential device in a jet plane may result in disaster; bad writing elsewhere can have as its most extreme effect merely boredom."[3]

Writing skills have their roots in education.

FORMAL EDUCATION

Technical writing is a peculiar field for many reasons. One of the things which hinders a more rapid development toward professional status is that many writers have come from diverse educational backgrounds. It is not surprising in a group of technical writers to discover five or six different fields of endeavor which were major studies in undergraduate school. Very few of us in the field of technical writing have ever seriously started on a course of undergraduate study with the ultimate intention of becoming technical writers.

There are two paths which the writer may have taken in his formal education. One of these is the path of scientific education or engineering

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[2] *A Report of a Study to Determine the Duties and Responsibilities Called for Under the Job Entitled "Technical Writer."* Report prepared June 1951, by Joseph Child and Robert Johnson under the direction of Harold N. Schleich, Supervisor, Technical Publications Research and Testing Laboratory, The Center for Technical Publications Studies, School of General Studies, Fordham University.

[3] Freedman, Morris, "Seven Sins of Technical Writing," *Technical Writing Review*, Vol. 4, No. 2 (June 1957) p. 23.

education where, in undergraduate school, the writer studied engineering or science. He received his bachelor's degree in one of these two fields. If he was one of the fortunate ones he did some graduate work in the field of either science or journalism before starting his writing career.

The second path is, of course, where the writer did his undergraduate work in the field of journalism. He probably had some course in science but his undergraduate degree was not in science but was rather in either journalism or English. In order to prepare properly for technical writing he would normally need additional work or training in the scientific field of his choice.

One of the most difficult things to measure is which of these two paths has the greatest chance of leading to success. Rensselaer Polytechnic Institute, Troy, New York, probably exemplifies the first path. Here the graduate has obtained his scientific or engineering training at the undergraduate level and could, if he so desired, seek employment as an engineer on a basis exactly equivalent to other engineers. This training is both a help and a hindrance depending upon the individual and the type of writing he does. If the writer has a genuine flair and interest in creative writing, engineering very probably is a good background.

Many fine technical writers have also taken the other path. A writer, truly skilled in his craft, can with the knowledge of the true functions of his job perform in an outstanding manner without the same fundamental scientific background an engineer would need.

As an example, Margaret Morrison Carnegie College, the women's division of Carnegie Institute of Technology at Pittsburgh, Pa., offers a four-year program in technical writing and editing leading to the degree of Bachelor of Science. This option, in the Department of General Studies, prepares women for careers in writing and editing technical articles, reports and manuals; in coordinating and disseminating technical information, and in public relations, advertising, and sales promotion with manufacturing and engineering companies. This course prepared the student for industry, government, and research organizations.

This is the journalism path.

But, the United States Civil Service Commission recognizes only technical training in science. They say, in their GS-1083-D (Technical Writing and Editing) classification series:

> "Excluded from this series are the following types of positions which may also be involved in the writing or editing of technical material:
>
> A. Positions of writers or editors who are dealing with technical material, but who are not required to have substantial subject-matter knowledge in the fields of work involved. Such writers and editors acquire a knowledge about the subject-matter field; this knowledge is gained through editing reports, articles, etc., from collateral reading and study, and through association with subject-matter specialists. In positions of this type the principal recruitment factor is training or experience in the fields of journalism or writing. In such positions knowledge about the broad field is preferable to intensive knowledge of a limited aspect of the field. These writers and editors must have a facility for acquiring, through interviews and reading, the subject-matter information which they need for the writing or editing project. Positions of this type are not classifiable to the Technical Writing and Editing Series."[4]

Very probably a technical writer in a highly specialized and technical field, writing what has become known as Engineering Data, such as handbooks or engineering reports, really requires a sound fundamental scientific background. On the other hand, a writer whose prime job is the preparation of brochures, proposals, or advertising matter often does not need this scientific background. He can do a better job with his journalistic tools.

A manager must consider the potential growth capability which an individual has. There is a feeling that formal education, particularly at a graduate school level, provides a higher upper limit to the vocational future of a writer. The more fundamental training the writer has the more depth and perception and background is available for him for future growth.

But education also has its nonformal aspects.

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[4] "Writing and Editing Position Standards," *STWP Review*, Vol. 8, No. 2 April 1961) p. 4.

NONFORMAL EDUCATION

Someone has said that a truly educated person never stops learning. A manager can measure a writer by determining how much he has learned from nonformal but organized forms of training. This learning includes participation in company-sponsored courses, working with professional groups in technical writing or editing, and other outside activities such as publication of magazine articles or books.

Many companies provide opportunities for in-plant training and study in managerial responsibilities or on-the-job training in particular classifications. The writer who uses this to his advantage is increasing his potential capacity for growth. The same thing applies in participation of professional organizations. Both STWP and the IRE Professional Group structure are examples of places where a person can participate, contribute, and learn about the areas directly related to his work.

Libraries are full to overflowing with books on graphic arts, exhibits and photographic shows abound, and trade shows are frequent in large cities. These all offer a wide opportunity to keep up with new developments in graphic arts. How a writer uses these opportunities for increasing his nonformal education is an important measure of the increase in his job knowledge.

Special college training programs are another valuable aid to the training and retraining programs for writers. Rensselaer Polytechnic Institute, Troy, New York, has a summer Technical Writers' Institute which tries to provide knowledge of all of the functions of technical writing.

The Institute also attempts to offer complete knowledge of special writing skills which can be applied to specific writing jobs. The writing workshop of the Writers' Institute is designed to put into practice the fundamental principles.

RPI also has a Medical Writers' Institute which has been designed to bring expert guidance to those who supervise medical writing, to those newly entering this expanding profession, and to those practicing writers who need an exchange of recent ideas. Other summer school and institute courses are also available. One of the topics covered at institute sessions is work control.

WORK CONTROL

All positions of managerial responsibility know how sensitive company structures are to the problem of work control. By this is meant the control of both time and money. In a cost-conscious organization the worth of a writer's contribution is often measured by how closely he keeps to his original budget. All of us are sooner or later exposed to the problem of estimating costs for at least a portion of a publication. These costs must be calculated based upon the environment which the person works considering the dollar value of the required writing, editing, artwork, typing, photography, and printing. Within a budget structure the writer, while he may not be responsible for the entire budget, must closely consider what he has available to do the job. A manager must look at what the writer produces for the amount of effort he has contributed and how all other parts of the budget have fared.

It is not enough to budget only dollars. How a person spends his time in working on his job is a truly significant measure. In most publications there is a fixed time available from beginning to completion. A highly skilled writer can usually spend valuable time in preparation and study before he begins a job. One of the marks of an incipient failure as a writer is the tendency to plunge ahead and write like mad before carefully considering the structure, framework, and time allocated for all of the parts for publication. A second meaningful period is just before printing. Any truly valuable writer will save the most important and precious hours to check his job carefully and then recheck it before it goes to the printer. Leaving no time for this quality review, while it is not fatal, is often very expensive.

Work control is important in publications for in the cold light of a profit and loss statement there is no room for excuses. Costs are most important where the publication is a contractual obligation. A manager who is measured by his cost controls will in turn use the same yardstick for his writers. Speaking of this aspect of control one manager has said:

> "The final point of organization, though certainly not the least important, is that of determining the relation of the department to the over-all organization of the company. There is a difference of opinion on this subject. There are some who believe that technical publications is a sales engineering service and therefore properly belongs within the sales division. There are others who will insist

that since all information for a technical publication emanates from engineering, the department should be part of the engineering division. Still others will claim that because most of the information is designed to be shipped with a finished product, that it is a production division function. The decision as to department responsibility depends on the individual company . . . But regardless of which company division the department becomes a part of, I would recommend and emphasize the need for a line status in the organization The department should receive full departmental recognition and report directly to a principal officer of the company. A technical publications department must be recognized as a company-wide service, not only an engineering service, or a sales service, or a production service."[5]

Line status means, of course, direct operating responsibility for the publications budgets. A part of all budgets is the writer's salary.

SALARY SCALE

Since all of us are employed so that we can support our families the problem of salary inevitably is a consideration. A manager has to look at the person's individual salary in several different ways. One of the fairest measures of a writer's salary is to try to compare this to what the writer is worth in the open market. This is not easy to determine. In some large metropolitan areas where many writers are employed, one can almost measure this by the help wanted ads. In other smaller cities, a true measure is difficult to find. Quite often the company personnel department will make a salary survey to find where the company stands in relation to other companies with related product lines. Obviously, if a writer is seriously underpaid he will have a tendency to become fair game for the "head hunters" who are always looking for more technical writers.

It is equally unfair for a writer to receive a salary which exceeds that of the norm or market value since this is costing the company more than it should. In a reasonably organized publications group a writer should be able to progress in terms of salary. It is the manager's responsibility to outline very carefully for the writer what the salary progression is, where the plateaus of promotion occur, and what the future might hold. A writer's salary in terms of the manager's viewpoint is a measure of his worth to the company within the salary structure. Any salary increase given to a person should be considered in terms of a person's entire salary history. A manager who approves a salary increase for a writer who is doing a good job should know at that time a proper future action in terms of salary if the writer's progress continues.

One of the things a writer is paid to do is to meet and work with people. All kinds of people.

INTERFACES

An interface is where one surface meets another. Where the customer and the writer meet is a very sensitive problem in human relations. The writer who is being considered for a promotion should have a sound and firm knowledge of his job. He should also be secure enough in his knowledge on what he is working on to discuss the inevitable changes and corrections with his customer. At the same time he must remember that he is fundamentally part of a service group. Many times minor changes suggested, in rather strong terms, should be made in the text rather than arouse antagonism.

If the writer probes deeply enough into his publications problems he will discover that there is one fundamental area of indecision. Changes and criticisms of a publication in preparation are very often the result of the customer, whether it be engineering or marketing, not being really sure of what it is he is trying to say. Many times a publication has gone through the complete cycle, including printing, without anyone raising the fundamental question of the actual purpose of the publication. A writer who carefully defines, at least in his own mind, the purpose, meaning and function of his publication will be able to assist the customer and cooperate with the chain of approval by relating these modifications, changes, and corrections to the original purpose of the publication.

In simple terms a manager must measure the ability of a writer to get along with others without having the others usurp his job. The others in this case are the writer's customers, company management, and possibly vendors. With each of

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[5]Goodman, S. J., *Organizing a Technical Publications Department*, presented at STWE Regional Technical Writers Institute, The Johns Hopkins University, Baltimore, Md. (September 11 and 12, 1959).

these the writer must have the ability to both receive and make suggestions with the fundamental aim of producing the most usuable document possible. If the writer can do this he can grow.

GROWTH POTENTIAL

Every writer who progresses within a group is considered to have potential for future growth, but it is obvious that not all writers can become supervisors or managers. It is part of the manager's job to evaluate the writer and to consider where the writer can go as his salary increases and as his responsibilities become greater. Usually, there is a quasi-supervisory capacity such as project leader or senior writer to which the more capable and experienced writer can advance. A position of this sort is usually preparatory to actual supervision.

No writing is of any value until the work is published in one form or another and available for use. Publications, whether they be engineering, instruction books, or marketing proposals require the coordination of a team. This group includes writers, editors, typists, proofreaders, printers, illustrators, binders, and librarians. A writer must, in the beginning, be only a part of a team. As his responsibilities grow his salary will increase. On small publications he may do all of the writing, but on large projects he will usually work with other writers, each contributing a part of the whole. The progression of the writer will be to a project leader whose responsibility is the entire publication. In this capacity he will direct and coordinate the work of several writers and perhaps the technical illustrators as well. Several project leaders, in a large writing group, usually report to the Supervisor of Technical Writing.

Supervisory jobs carry with them the responsibility for not only job performance, but the ability to deal with subordinates and a host of other problems separate from technical writing. A manager who promotes a writer and intends to have the writer assume supervision at some later date should plan some reasonable path to responsibility so that the writer can grow into the job.

JOB ROUTE

Yet another measure of an individual writer's worth is how he arrives at his job. This can provide managerial insight into whether the writer should be promoted. The writer's job history including his training and earlier experience should be examined in light of his existing responsibilities. Someone with adequate college training and with a work history of experience in writing or editing can be promoted to additional responsibilities based upon this work experience and training. A manager might find on examining a particular writer's background that there are certain weaknesses in either experience or training. A person in this position should be given an opportunity to correct these deficiencies if he expects ultimately to become a supervisor.

There are, we all recognize, many people in the field of technical writing who are there by sheer accident. For one reason or another, people in this category assumed the mantle of a writer largely because they were in a job situation where there was an opening and they were asked to take a writer's job. While there are many people who started without proper training it is important for both the manager and the writer to recognize that the pressures within a company sometimes have a tendency to create a false job environment. An example of this is a person who becomes a junior writer and works for a protracted period of time on a particular piece of equipment or one small area of technology. This writer can be under the illusion that he is a technical writer because he is paid for writing and that is his title on the organization chart. But lacking the proper training, background, or experience, such a person usually lacks the depth of knowledge or understanding to make a gradual progression of increased responsibilities.

A job route is important but it is significant not only to look at how a person travelled but where his road led. Some people have this negative attitude toward writers:

> "The burden of report writing has become great enough so that the technologist finds his time being appreciably eaten into by the reportorial operation. He has consequently begged for and received assistance in the form of what is called the technical writer. Many organizations function to a quite satisfactory degree upon the simple assumptions that are made when one hires a group of technically trained persons to do the scientific work and a staff of technical writers to report and document that work for others and for posterity. Let us examine the ideal technical writer.

First, he is a composite: he is, at once, a linguist who expresses himself lucidly, freely, accurately and, indeed, interestingly, and at the same time he is also a sound technologist.

"The ideal technical writer (and this definition is really being written from the point of view of the technologist) is an alter ego for the engineer, and should be able at any time not only to sit down and write out a complete report on what the engineering and his project have done over the preceding few weeks or months, but also to assemble the results, interpret them, and even second-guess the engineer on what the next period will involve. In general, he relieves the engineer of all repsonsibilities for clearly thinking out his work so that he can communicate it."[6]

If this is true the writer truly has a bumpy road. But, in a positive sense, a writer is more than this. When the manager encourages a writer he can hold up a proposal.

"First, and most important, the proposal is a selling document representing the company. It must get results to pay for itself. Unlike other publication documents, it will be reviewed only by management prior to acceptance, and it cannot be revised once it is submitted. If it is not accepted, or rather if it does not accomplish its purpose, it has resulted in a nonrecoverable expenditure of company money. In almost every case, the entire cost of proposal preparation is paid for by the submitting company. If it does not result in a production contract, its cost cannot be regained.

"Second, when proposals are prepared, the engineering departments are very much aware of their need for the help of the Publications Department. Publications is no longer just a service department producing the required fringe of an equipment contract; it is now a vital part of a documentation team. Technical illustrators are needed to prepare artists' conceptions and other quality artwork from the roughest sketches and instructions. Writers and editors are needed to coordinate masses of text from various engineers and to produce a well-organized publication with continuity and a sales approach. The production man has the tremendous job of coordinating and scheduling reproduction. His knowledge of reproduction costs and his scheduling of work to the printer can result in dollar savings, for proposals are always deadline items and may necessitate overtime or extra printing charges."[7]

From this a writer is an important member of the company team. The manager should tell his writers they are on one of the parallel paths of job progress.

WORK APPROACH

The final factor affecting the writer in the manager's decision to dismiss or promote is the writer's approach to his work. It is believed that the best writers have a certain inborn sense of creative urgency which separate the professional writer from the nonprofessional. Probably the best measure of this is the sense of identification that a creative writer feels in his job assignment. Whether it is a simple technical order, or a brochure, or an advertising piece, a writer of this caliber is never really satisfied with his work. He feels that each publication should stand on its own, that it should be an entity, and that it should have an identification and meaning of and by itself. A person who feels like this feels that writing is a true creative expression. Such a writer will, if given proper guidance and assistance, turn out technical publications of the highest quality.

The ultimate approach of the person who is writing, but who could well be doing something else because of his fundamental lack of creative excitement, will lack the specific needs to produce quality technical literature. This perhaps overstates the case but in my experience the work approach of these two types of writers is totally and completely different. If you, as a manager, discover a real writer, treat him with respect and indeed honor. It is from people like this that a truly professional writing group is made.

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[6]Chapline, J. D., "The Editorial Function in Scientific Organization," *IRE Transactions*, Vol. EWS-3, No. 2 (July 1960) p. 49.

[7]Moore, William Luke, "The Publications Department's Role in Proposal Preparation," *STWP Review*, Vol. 7, No. 3 (July 1960) p. 8.

PIONEER OR ESTABLISHED PUBLICATIONS GROUP— WHICH IS BEST FOR YOU?

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This paper discusses the opportunities available in two kinds of publications groups — the established group and the pioneer group — which are defined in the paper. These two groups are then related to three types of writers: the writer with progressive experience, the writer with specialized experience, and the inexperienced writer. A writer's personal considerations which must be weighed before joining either group are listed.

INTRODUCTION

This paper does not offer a precise formula to be used by a technical writer in determining whether he should remain in his present job or leave. The primary intention of this paper is to discuss the opportunities available in two kinds of publications groups: the established and the pioneer group. Specifically, the tone of this paper will be geared to certain characteristics of a technical writer and the opportunities available in the two groups as a function of these characteristics. These characteristics are the depth of his technical knowledge, the variety of his writing experiences, and most important, perhaps, his personal preferences.

In the following discussion, which is concerned with either a pioneer group or an established organization, both of them are successful. How the initial and continuing success of either could be achieved would require a considerably longer paper.

DEFINITIONS OF ESTABLISHED AND PIONEER GROUPS

The established organization already has the manpower, the supervision, the equipment, the facilities, the "know-how," and the support services necessary to getting the job done. Simultaneously with getting the job done it is adding to its technical depth and further solidifying an already solid reputation.

The pioneer group, on the other hand, while it is in the process of getting the job done must invariably be obtaining the manpower, supervision, equipment, facilities, and support services all vital to getting the job done. It usually has the "know-how," but much of its vital energies are expended in growing pains.

These are the essential differences between the two groups; one is in, the other is getting in, each is successful. Do not get the impression that success is measured by volume of output. First-quality performance is being stressed in this paper.

CONSIDERATIONS FOR EXPERIENCED WRITERS

First presented are some considerations for the experienced technical writer who is already part of an established organization; and by "experienced" is meant at least five years of technical writing and related experience. There are usually two types of writers who fall into the category of experienced writers. These are the writer who has had progressive writing experience, and the writer who is a specialist.

The writer who has five years of writing experience, whether it be progressive or specialized experience, will not have a difficult decision to make if he is next in line for immediate promotion. He will want to remain in the established group. He is at least provided with a corps of personnel he already knows and has, perhaps, already evaluated. His primary problem, then, will be one of shaping up the group, of sharpening its focus, of developing the full potential of the personnel. There is challenge in such a task.

The writer who has five years of progressive writing experience and who feels that he is a second-string quarterback on a championship team will probably not need to be told to look around. There comes a time in any good publications group when a good manager has depth in reserve; this is a goal which managers are trying constantly to achieve. Thus, if an experienced writer has capable, young management above him and stability settling in, he is probably aware that new publications departments are constantly being formed and that their managers are just as constantly looking for good line supervision. Should such a writer decide to make a move to a pioneer group, to take full advantage of expansion of opportunity, he would do well to join during the first two years of a pioneer group's growth. The door to rapid supervisory opportunity in a new publications department begins to shut about the third year.

The writer who has specialized experience might find himself handicapped in a pioneer group. His experience may be good experience, but it is somewhat narrow; it may be restricted to the preparation of one kind of publication, or the writer may have written only reports, perhaps only proposals, perhaps only certain types of handbooks, perhaps even only particular sections of these kinds of publications. Pioneer publications departments usually cannot use such specialists during the first two or three years of their operation.

The experienced writer, regardless of the type of his experience, may not relish the thought of proving himself again. But this is exactly what he may be required to do if he leaves to enter a pioneer group. One might ask whether such a proving process might not be required even if he were to leave one established group for another established group. It is true that he would be in familiar territory; everything would be organized and orderly. His moment of truth would come quickly. If a technical writer has worked hard, has proved himself, and has acquired an excellent reputation, it is not an easy thing to slip off and begin again. Many technical writers have had the rewarding experience of being accepted by a "tough" engineering department, usually after an extended period of time. One does not lightly give up the benefits of an established reputation to go through the harrowing experience of proving himself again, to face perhaps even tougher engineering departments and an even more difficult struggle for acceptance. These are things a technical writer cannot avoid considering before he decides to venture into a pioneer group.

The experienced technical writer, despite his experience and despite his being in an established publications organization, may not know all the basic fundmentals of illustrating and reproduction practices, the new photographic techniques, and the complexities of cost and production estimating. This writer might do well to acquire these fundamentals before he seriously considers offers with pioneer groups. During the first year or two of growth and development in a pioneer publications department, the technical writer will inevitably find himself involved in all the production activities of the department. And invariably those with whom the technical writer will be working, especially personnel outside of publications, wlll expect him to be an expert in all things related directly or indirectly to the publications effort.

A technical writer who has had five years of progressive writing experience will want to give some real thought to joining a pioneer publications department, especially if he has supervisory ambitions and can offer what the pioneer group will demand. The manager of a pioneer group must have immediate supervisory strength, and he wants it to be flexible, adaptable, and full of potential. Ideally, he must have leaders who know how to write manuals, proposals, brochures, procedures, and engineering reports. This ideal is rarely achieved, of course, but in practice it may be approached. The writer who has these skills and who can roll with the problems of deadlines, cost control, and personnel and who demonstrates qualities of vigorous leadership is likely to become a supervisor. But it is unlikely that a technical writer will be made a supervisor if he has had less than five years of progressive writing experience.

CONSIDERATIONS FOR INEXPERIENCED WRITERS

The established publications group can usually provide the inexperienced writer with the necessary close, developmental supervision better than a pioneer group can. And the better organization of the established group will permit the inexperienced writer to master advanced technical writing in a more logical progression of steps, and usually with better direction and more realistic guide lines.

The pioneer group, however, will welcome the young writer with some experience and possessed of a measurable potential. But during the first two years the young writer will usually be shifted rapidly from one area of crisis to another, mainly to assist more experienced writers in putting out fires. For one reason or another certain writers relish this kind of experience; others merely find it frustrating. The writer should consder the effect this kind of experience will have upon him.

PERSONAL CONSIDERATIONS

The pioneer organization is inevitably more hectic, apparently directionless, and pressured in its operation than is an established publications organization. Therefore, there are certain personal considerations which should be carefully weighed by the writer who is giving serious consideration to joining a pioneer group. The more important of these considerations are summarized briefly below:

Willingness to travel. The odds are good that there will be extensive traveling to confer about schedules and rescheduling, to obtain first-hand interpretations of specifications and ground rules, and to gather detail information. Much of this travel will be done on personal time during evenings and over weekends.

Willingness to perform support tasks. During the formative years of a pioneer group, the technical writer is called upon to perform typing, assist in proofreading, do layout work, and give freely the use of his legs in the dozens of liaison activities. This is the case because the early availability of personnel, equipment, and facilities can never be perfectly coordinated, so that not only will support services be somewhat disjointed for some time, but some writers will find themselves trapped into doing many of the tasks usually associated with personnel of lesser skills.

Physical stamina. In a pioneer group it goes without saying that one must be in good physical condition. The long hours alone can be extremely exhausting. Add to this the extensive travel, the inevitable leg work, and the constant crises.

Willingness to take criticism. Because the writer will be handling a multiplicity of assignments in a new organization, he will undoubtedly make mistakes which breed criticism, some of it sharp and to the point, some of it seemingly personal. If this happens, he must be able to take it.

Working with a fluid system of operational procedures. In a growing organization, procedures will invariably change to meet new conditions. What was right yesterday is wrong today. The writer must be able to grin and bear it.

Willingness of family to make a change. The family point of view is not to be taken lightly. If a job does not give the writer full professional satisfaction and if his family is only mildly happy with its present environment, moving should present no problem. Today, relocation even from one coast to the other is not difficult. And if he is a good writer, conscientious and socially adaptable, he will find that within a few weeks, he and his family will not lack for friends. Before the writer commits himself to the new location, it would be wise for him to prepare objective checklists as a guide to decision.

CONCLUSIONS

In conclusion, the statements of this paper have been primarily geared to those experienced writers who have supervisory ambitions. Newer, less experienced writers will have to extrapolate for themselves from the primary considerations.

After three years of existence, a pioneer organization usually takes on many of the characteristics of an established publications group. Naturally, then, promotion-to-supervisor opportunities develop no more rapidly than they do within an established organization.

If a writer has the required technical depth, the technical writing experience, the intelligence, and the leadership qualities so much in demand, he can, by joining a pioneer group, gain from three to five years in supervisory status, but he should join the pioneer publications department during its first two years of growth, at the latest three.

If he is an inexperienced technical writer, he probably will gain more first-quality experience by first joining an established department, but if one is a good writer who does not particularly want supervisory status, he will probably do equally well in either group, both in terms of prestige and salary.

A HARD LOOK AT THE JOB OF THE PUBLICATIONS/COMMUNICATIONS MANAGER

by Gunther Marx
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This paper provides a critical analysis of the manager as viewed from three principle perspectives: top management's his own publications/communications department's, and from the manager's personal viewpoint. The paper examines the manager in a variety of complex but typical business situations and seeks to define the qualifications needed for effective managerial performance.

A KEY POSITION — VARIOUSLY VIEWED

We're going to take a hard look at the job of the publications/communications manager. To accomplish this, we will have to dig considerably beyond the narrow, formal, somewhat restricted job write-ups found in every written position description for this management position. Our method will consist of analyzing this job, critically, from three basic perspectives: that of top management, that of the manager's own department, and that of the manager himself. These three different viewpoints afford an opportunity to probe into the diversified tasks, the often loosely defined, broad, multi-faceted components of the job, and it is hoped will form a more solid basis for a meaningful self-evaluation to determine your own suitability for the management profession in the publications and communications area.

TOP MANAGEMENT'S VIEW OF THE PUBLICATIONS/COMMUNICATIONS MANAGER

Interpreter of Top Management Goals

Viewed from the vantage point of top management, perhaps the most significant single qualification of the publications/communications manager is his ability to translate top management's ideas into effective, creative publications and communications materials. More often than not, these ideas are first expressed as surface thoughts only, or perhaps as broad, general, and often vague concepts, which must be absorbed, analyzed, interpreted, and implemented effectively. For the manager, this interpretive function represents a continuing challenge: on its effectiveness frequently depends the total impression — the image, if you will — which the entire company projects to a public or to many publics in a number of different communications media. Thus, top management must be able to place full reliance on its principal executive (generally a director or manager) in the publications and communications fields for meaningful, creative, expeditious interpretations of ideas and concepts into tangible communications products reflecting management thinking.

Recommends Communications Programs and Approaches

The advisory function of the publications/communications manager quite naturally calls for considerable initiative on his part: He must be prepared, at any time, to recommend to top management specific communications programs and approaches to implement top management's policy directives. Most managers discover that they are called upon to carry out immediate as well as long-range management goals, and that their effective implementation often requires the application of different and, on occasion, of conflicting policies and objectives. For example, how is one successfully to walk the tightrope between the pressure of public relations to produce more and better publications and communications on the one hand, and the counterpressures imposed by the patent department, the latter rightly fearful of premature disclosures and their effects upon the company? In a different area, how does one avoid the pitfalls of beating out the competition by withholding of proprietary research and development information on the one hand, and the need constantly to keep your company before the public by announcing the new products and processes resulting from a vigorous R&D program? In such potentially sticky areas, a publications/communications manager must advise top management of the anticipated results, both pro and con, of a given project. This requires the liberal application of a high degree of initiative, alertness, diplomacy, and an uncommon amount of common sense.

Communicator and Interpreter For His Group

Top management's requirements with respect to staff and line managers are many and varied, but in the case of the person responsible for publications and communications, an immutable requirement is that he be highly articulate. This qualification is essential not only in the more routine communications functions with which the manager is entrusted, but is a basic requirement for and ingredient of effective communication with top management — itself generally consisting of articulate individuals. It is also indispensable to the manager's communication of the expert knowledge and ideas of the personnel in his own group to members of top management. Nowhere is a sure command of language — including subtleties of expression, as well as precision, clarity, and conciseness — put to greater test than in the day-to-day management of a publications/communications department. It is always an immediate requirement, but it is also a continuing one, calling for the application of all one's inner resources: it is a continuing challenge — one that is rarely mentioned but a challenge of the first importance.

Performance Level and Conditions

Among the many performance standards expected of the publications/communications manager is his ability to perform well under conditions of almost constant pressure and exceedingly tight deadlines. Although, superficially, this requirement appears to be so basic as to be taken for granted, it is well to point out that the manager is exposed to the kind of ever-present strain which, unless properly handled, can reduce severely his effectiveness. Not only must the manager personally perform ably under often very trying conditions — he must, at the same time, inspire his department to operate at highest productivity, as individuals and as a group. Again we are discussing an intangible—a condition which really cannot be defined, and can be measured only by actual performance. Yet it is precisely in intangibles such as this one, and in the sum total of all such intangibles, that the real key to management effectiveness may be found.

Quality and Cost Consciousness and Control

As a professional manager, the person in charge of publications and communications is expected to exercise continuous control on quality as well as on costs relating to all the end products of his department. And this control, let there be no doubt in anyone's mind, extends to all work performed for his department by persons outside the group, such as subcontractors, vendors of services, freelance artists and writers, and others. The manager's responsibility for quality and cost controls, however, goes considerably beyond those projects in which he participates personally. One of his most important responsibilities in leading an effective creative department is the ability to instill quality and cost consciousness in the personnel of his department, and particularly in the key professional and supervisory staff. Once this has been accomplished, an automatic quality and cost control system will have been established which can be counted on to work well, despite pressures, deadlines, audits, or other controls.

Hand in hand with quality and cost go the operating and capital equipment budgets, both of which generally are the initial responsibility of the manager. Once approved and instituted, it is the manager's responsibility to operate effectively within these budgets. In case of anticipated exceptions and overruns, it is the manager's responsibility to advise top management accordingly, and to set up the necessary fiscal machinery and controls to carry out new programs, or to extend the scope of existing ones. In all of these operations, a built-in awareness of quality and costs is expected by top management.

Expertise Expected

Another fundamental qualification of the publications/communications manager, as viewed from the vantage point of top management, is his expertise on all matters pertaining to the broad area of publications and communications. This means that he must be available to counsel top management in all aspects of these critical items. Thus, the manager is acknowledged to be and must be counted on to be the recognized expert on all publications and communications matters in process, planned, and envisioned. In line with this, he takes intensive periodic looks at his company's over-all communications practices to uncover areas for improvement and upgrading. This assumes, on the part of the manager, an expert working knowledge not only of all phases of his company's efforts in the preparation of publications and communications, but a thorough familiarity with "outside" industry practices and procedures as well. In a larger sense, top management's right to depend on the manager for expert guidance in all matters affecting publications and communications programs implies the virtually immediate availability of the manager to review publications and communications programs, to work with top management on new and expanded programs, and to serve as a consultant in special projects — particularly those in which his personal expertise, backed up by the professional staff of his department, can be brought into play effectively.

Essential Flexibilities

Among the many intangibles associated with the manager's function, probably none is more difficult to pinpoint or to define than the requirement for mental flexibility. This is a quality upon which most alert, progressive top managements place heavy emphasis, and with justification. In most modern industrial organizations, the requirement for mental flexibility is put to test almost on a daily basis, and he who is unwilling or unable to adjust to rapidly changing conditions proceeds at his own peril. Thus, top management expects the director or manager of the publications and communications programs to have the mental flexibility to redirect his department, to reorganize where and when necessary to meet the needs of new programs, and to shift emphasis in productivity and department performance, both in short-term and long-range operating techniques. Such shifts may be dictated by changes in top corporate policies, budget and appropriation factors, contract requirements, and so forth. The pace of today's technology is much too rapid to permit successful corporate operations in all areas without managerial flexibility. In the area of publications and communications, this requirement is a cornerstone of effective operation.

Inspiring and Effective Leadership

Perhaps the one quality top management is constantly appraising in its key management personnel is, stated very simply, the ability to manage. In this area, perhaps the two crucial questions to be answered are these: Can the manager and does he in fact inspire his department to contribute at its maximum individual and total effectiveness? Does he properly encourage the application of individual inventiveness and imagination? These questions are not as difficult to answer as might be believed: just take a good look at the group's output! If this output is adjuged to be consistently below par, then the two questions obviously are answerable in the negative. If, however, the opposite is true, then chances are that the manager indeed is doing his job, both personally and vis-a-vis his group.

A PUBLICATIONS/COMMUNICATIONS DEPARTMENT'S VIEW OF ITS MANAGER

Principle of Intercession

Viewed from the critical standpoint of the manager's own staff, one of the key characteristics an effective manager ought to possess is a willingness to exercise the principle of intercession. Specifically, this means that the manager's staff expects him to be ready, at all times, to intercede on behalf of the department in recommending ways and means to achieve the most effective preparation of publications and communications products. This imposes upon the manager a continuous responsibility to apprise management of the special talents and creative skills represented in his department and, at the same time, to keep top management informed of any special problems, such as those, for example, inherent in staffing, quality control, deadlines, priorities, and so forth.

Rapport with Staff

As a prerequisite to the principle of intercession and of equal importance for effective managerial performance, from the viewpoint of the department, is that its manager consciously develop and actively maintain with his staff the kind of rapport which will permit him to interpret their ideas accurately to top management. How does a manager develop rapport? Obviously, no simple answer is possible. Perhaps the best answer can be found in a combination of factors, among which the application of the principles of good, close, personal two-way communication probably is the most important. In the final analysis, of course, rapport with the staff is dependent to a considerable extent upon the personalities involved. This, in turn, points up the critical nature of the recruiting and staff development functions. More about this point later.

Consciousness, Implementation of Advancement Goals

Another key quality the staff looks for in its manager is a deep concern for the professional development of the staff members. Thus, it is vital to morale that the manager be ever-mindful of the ambitions and aspirations of his staff. To implement this goal, it is incumbent upon the manager to stimulate individual growth and professional expertise, to encourage formal as well as on-the-job training, and to stimulate active and meaningful participation in the professional activities of his staff. In discussing these essentials of effective managerial performance, it must be recognized that the manager's attitudes, personal application, and conscientious concern with these problems often can spell a significant difference: the difference between a department operating at a high level of professional competence, creativity, and productivity — and one in which, although the work is performed, it lacks the ingenuity, the sparkle, the freshness of approach that are so frequently a reflection of effective managerial performance.

Interprets Top Management Directives

Members of a professional staff have a right to expect of the manager that he convey to them, fully and clearly, the policies and directives of top management affecting the operation of the department. In many instances, this may indeed be a tall order, especially when policy or outline directives must be interpreted and then implemented through the day-to-day operation of the group. Effective interpretation of top management policies and directives covers not only the applicable policy statements and directives. It also encompasses interpretation of unwritten guidelines as well as interpretation of the spirit and intent of top management direction. To accomplish this with the degree of success expected of him requires that the manager be familiar with company philosophy and direction, that he make it his business to keep fully informed, and that he consider the accurate transmission of this type of information to his group to be among his most important managerial responsibilities.

Manager as a Pivotal Agent

A manager quite naturally is under constant scrutiny: downward from the vantage point of top management, upward from the viewpoint of his staff, and laterally as seen through the eyes of his fellow managers. Seen through the frequently critical and perceptive eyes of his professional staff, the manager can be said to carry out a pivotal function: on the one side, he represents management to his staff; on the other, he represents his staff to management. This is not meant to imply that a certain schizophrenic personality is a requisite to good management but, rather, that the manager must have an ability to retain proper perspective, to serve as a key communicator, and to balance and reconcile occasional conflicting pressures.

A MANAGER LOOKS AT HIMSELF: INTROSPECTION INTO SOME ESSENTIALS IN MANAGING A CREATIVE DEPARTMENT

The "Big Picture" — and All the Small Ones

Seen through the eyes of the manager's severest critic — himself — a basic qualification in managing an effective department is the manager's capacity and ability to direct successfully a large number of parallel programs and projects. Here, the manager's function is differentiated from that of the supervisory and professional staff by the greater number of different programs and projects which are his clear-cut responsibility. In the manager, then, rests responsibility for carrying to effective completion the broad goals of the organization and the policy directives and objectives outlined by top management in the publications/communications area. This responsibility demands that the manager apply himself fully to carrying out the multiple projects and programs — by making meaningful use of his mental and physical energies, his professional expertise, and his stamina and endurance. His personal interest and conviction will help to assure the kind of output which is a credit not only to himself and to his staff, but equally to the organization whose image is reflected in the various end products that emerge from his department.

Manager as Department Personnel Chief

Unless the manager of a creative group is willing to devote a considerable portion of his time and energies — and on a continuous basis — to the many personnel matters inherent in effective group performance, his effectiveness — and certainly that of his staff — will be in serious jeopardy. In fact, as personnel chief of his department, the manager must regard the recruiting and development of a first-class staff as probably his most important and surely his most far-reaching function. As personnel chief, he must be willing to interview meaningfully and intelligently, regardless of the drain on his own time and energies. In this function, he must use all his analytical, interpretive, and intuitive faculties. At the same time, he must be prepared to interview a large number of qualified applicants, the majority of whom probably will not be offered employment. He must recognize that mistakes in recruiting are often extremely difficult to correct, and that whatever extra time and effort are spent in recruiting a superior group will pay off a hundred-fold in terms of future staff performance. To encourage professional development of his staff, the manager must be alert to opportunities for promotions of his staff members, and must be willing — even though it hurts — to encourage promotion to positions of greater responsibility outside his own department. No effort made by the director or manager in his role as personnel chief is too great: these efforts carry with them long-term rewards for the manager, for his staff, and for his organization.

Maturity and Know-How

Another "must" for effective managerial performance is that the director or manager of publications and communications be a constant quality control expert. We discussed this previously as an underlying and built-in characteristic of the management function, and mentioned that it involves expert judgments not only of in-house performance, but of the quality of vendor and contractor services as well. At the heart of this lies the manager's skill in judging the quality of writing, artwork, design, photography, typesetting, printing — not only in knowing good from bad but, more importantly, in being able to point out effectively in each case, where and how to improve quality. This is the kind of skill that develops slowly and begins to mature with years of experience only. At its heart, however, lies the manager's professional interest in the critical and constructive appraisals of publications and communications. Again, emphasis is placed here on the kind of intellectual inquisitiveness which permits and stimulates creative appraisals of creative publications and communications. It should be remembered, also, that every manager of a creative group is given a rare and unusual opportunity to further his own growth as a manager by becoming more and more intimately familiar with the various approaches and processes that constitute his milieu. There exists not a single manager today — and it is perfectly safe to predict that there never will exist one — a manager who knows all there is to known about writing, or artwork, or design, or photography, or typesetting, or printing. There's not a single manager today who knows all there is to know about what makes an effective publication, a meaningful management communication or presentation, an outstanding technical report. This is pointed out to underscore that, in the constant opportunities for learning inherent in the world of publications and of communications, there lies an ever-present challenge and one, happily, that can never be fulfilled completely.

Estimating and Scheduling

The manager's contribution as an expert estimator and cost controller is a natural outgrowth of his funtion as a quality control expert. Again, estimating and cost control are techniques which can be taught, but which, in the final analysis, can be applied meaningfully only after considerable experience in the field. These functions apply equally to internal and to external situations; they require, on the part of the manager, that he be prepared to recommend alternatives. Thus, he must know of the availability of alternate approaches and processes, and of their relative pros and cons in terms of costs, quality, amount of control, deadline factors, and manpower considerations.

Decision-Making, Initiative, Authority, Responsibility

The decision-making process, quite obviously is a basic ingredient of effective managerial performance. From the moment he appears on the scene until he leaves his office many hours later, the manager's day revolves around a steady stream of decisions of varying size and ramifications. Most progressive managements today recognize that a high degree of managerial initiative, authority, and responsibility are the true cornerstones of effective managerial performance. Thus, the manager must be alert constantly to ways and means of increasing the effectiveness and productivity of his department by actively and vigorously accepting the many challenges inherent in the management function.

Arbiter of Competing Factors

In many ways, the constant decision-making responsibilities of the manager are somewhat analogous to the duties of a traffic policeman stationed at a busy downtown intersection. In his capacity as chief arbiter, the manager is called on constantly to satisfy competitive and sometimes conflicting and overlapping demands. These are imposed not only by the natural forces created by priorities, deadlines, available manpower, and budgets; they also are created in a very real sense by the different personalities of the requestors asking for departmental services. Commonly, requestors are other managers, department heads, scientific and technical specialists, and key staff and line groups. Additional requestors are the members of the corporate or divisional top management, each of whom has the right — and it is likely to be exercised frequently — to cut through all the normally established mechanics of operation in order to expedite special assignments. This, then, requires that the manager possess the flexibility which is necessary to permit the rapid changes in priority and scheduling which are required to expedite special projects. More often than not, top management regards the effective handling of special projects as an even more meaningful measure of a department's — and of a manager's — performance than the execution of the regularly scheduled projects.

Working Relationships with Management Peers, Others

The kind of working relationships which the manager develops with the different members of the organization often is a highly accurate gauge of his effectiveness as a manager. Previously, we stressed the personnel functions of the manager in creating an effective and close working relationship with his own staff. This same attitude, modified only for the particular group involved, applies to the manager's relationships with his management peers, with the key scientific and professional staff of his organization, and with the various members of top management — especially with those likely to be requestors for departmental services. Working relationships are not created out of thin air: rather, they evolve and are developed out of working situations in which there exists a spirit of cooperation, of give-and-take, of mutual respect, and of consciousness for the other's problems and responsibilities. The manager who makes it his business consciously to develop these working relationships will make a far more meaningful contribution to his organization than the one who does not make such an effort. Moreover, these working relationships will help the manager to get closer to the operating pulse of the over-all organization — a condition of particular importance to the management person in charge of publications and communications.

Manager as Eternal Shock Absorber

Finally, no honest introspective look into some of the key essentials in managing a creative department can ignore the function of the manager as a perpetual shock absorber and incarnate buffer zone against pressures downward, upward, and laterally. Since this shock absorbing and buffer function is connected intimately with the high productivity, quality, and creative performance of the group, it constitutes one of the real criteria of effective management performance. That this function makes heavy demands upon the manager is quite obvious, and affords an insight into why the management profession, despite all its possible rewards, should not necessarily be considered a universal goal.

IS THE JOB FOR YOU?

If you have gathered that the job of the publications/communications manager is a highly responsible and complex one, requiring the effective combination of many divergent skills, tangible and intangible, you're on the right track. In the final analysis, the decision to enter the management profession in this field must remain a highly personal and individual one, requiring the careful evaluation of many interrelated factors.

Some of the less tangible key characteristics that make for an effective director or manager of publications and communications have just been discussed. This paper has emphasized that a manager's success depends very heavily upon his ability to work under constant pressure, to possess and to exercise mental alertness as well as physical stamina, to be an articulate interpreter of loosely-defined objectives, to possess and to use his interpretive faculties to the fullest in the decision-making and other management functions. All of these factors are part of the undefinable "flair" to manage without which management becomes an impossibility.

Perhaps one more key characteristic should be mentioned; one that is essential for survival in today's world, but is particularly applicable to effective management: a healthy and reliable sense of humor. Unless you've got one, unless you make use of it, unless you can look to it to maintain your own equilibrium and that of your associates — do not venture into management — particularly the management of a group of creative writers and artists.

MERIT EVALUATION, ORGANIZATION SIZE, AND MANAGEMENT IN A SUBCONTRACTOR'S HOUSE

by Samuel A. Miles
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This paper points out that the expanding subcontract type of publication organization offers the best potential for technical publications people interested in management. A brief description of the growth of a subcontracting house and how managers grow from within the company is presented. Another way of growing into management is to set up an office in another city.

The theme of this paper is that the expanding subcontract type of publications organization offers the best potential for technical publications people interested in management. This statement is based upon almost 20 years of experience in the three major areas of employment for technical publications personel — government, large industrial organization, and the subcontractor house.

It is precisely in the area of management that the subcontractor presents opportunities for rapid growth. Other conditions of employment are, broadly speaking, equal. Salaries, vacation allowances, fringe benefits, working conditions, and all other measurable factors add up to about the same. One company may offer slightly lower salaries but unexcelled fringe benefits, etc.

But in the area of management this paper presents certain facts which will enable you to make decisions based on your own needs, objectives, and abilities.

The subcontracting house with which the writer is associated started as a two-man operation in 1945. It now employs hundreds of people coast-to-coast. It is obvious that successful operation in a highly personal service business requires astute management.

Yet the house has never hired a manager or his equivalent. For example, two vice-presidents in their early thirties, and the president of one of our subsidiary corporations, also in his early thirties, and a number of other managers have come from within the parent company. Each was originally employed because of his technical competence, either as a technical writer, illustrator, or book production man.

If the technically competent man does well, he can continue to grow in his technical specialty. If he enjoys the confidence of the clients for whom he works, he will eventually find himself with more work than he can handle. He will then have a group of people reporting to him — and his growth will be reflected in an increase in the material and status symbols of our American way of life.

But there is another way of growth. Top management decides that Radar City affords excellent opportunities for business expansion and that Joe Smith, who has impressed management with his abilities, is the logical choice for the job.

Joe Smith is the logical choice because he has impressed management with his potential as a man possessing real rugged pioneering qualities.

Why are these qualities so necessary? Because the only real directives Joe Smith receives are two in number. One is that he must maintain and strengthen the ethical and professional reputation which the company has slowly built up over many years. The other is that for all practical purposes he is in business for himself, and that his division must, as any other successful business organization, operate profitably. Perhaps one other point might be added which Joe knows very well because of his long association with the company — that he is to stick to the field he knows — technical communications — and that he is not to waste his energies investigating motels, boatels, desert land, or canned horse meat for dog food.

Joe Smith goes to Radar City. To summarize the problem, he has to find a suitable office, hire people, obtain contracts, and produce the work to the clients' satisfaction — and profitably from the company's point of view.

As you can see, this is quite unlike the situation in a large company. In a large company the publications manager has a personnel manager, a sales manager, an office manager, and many other support personnel upon whom he can lean. He is also bound by the traditions of the parent company and may have to attend committee meetings, write long reports, and justify his proposed actions before action can be taken.

Joe Smith, on the other hand, is encouraged to develop an organization which reflects his own abilities rather than develop the imitative type of organization so often found in a large company. It is only in this way that Joe Smith can be successful.

That the policy is successful, and that the Joe Smiths are successful, is empirically shown by the growth of our company over the years.

Are you a Joe Smith? If you are, there are plenty of opportunities waiting for you in the management phase of technical communications.

PANEL 10 — TECHNICAL EDITING: THE BRIDGE TO UNDERSTANDING

EDITING: FROM ENGINEER TO ENGINEER

by John B. Bennett
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The criteria of editing an engineering report for engineers are correctness, completeness, and comprehensibility, considering that the intent of the document is to direct, to inform, and to persuade.

Almost every engineering group has its output of written reports. If professional editorial help is not at hand, the supervisor must usally edit such material before he releases it. Too often, the supervisor does not know where or how to start his editing, so he procrastinates. Or he spends fruitless hours tinkering in the vague but pious hope that any change will be for the better. His tinkering is apt to center on the obvious factors — grammar, style, format, and the mechanics. These matters are certainly important; it is equally certain, however, that they are not of prime importance. This is particularly true for those reports which are written by an engineer for engineers; in such cases, it is the contents which are of primary concern.

Consider these simple sentences as an illustration:

> One Yard is equal to 27 inchs.
> Take out 1/2 (a half), pound out form in the stock Room.
> Phylogeny is said to be recappitulated by ontogeny.

Correct the grammar, clean up the spelling and punctuation, edit the sentences for style. Now look at the results:

> One yard equals 27 inches.
> Take 1/2 pound from the stock room.
> Ontogeny recapitulates phylogeny.

The sentences are still unacceptable. They lack:

> Correctness
> Completeness
> Comprehensibility

These are the first qualities a supervisor must look for in the reports he edits.

No matter what its final destination, an engineering report must be correct, complete, and comprehensible. Of the three, correctness is probably the requirement whose implications are least likely to be misunderstood. Notwithstanding, the supervisor must ask such questions as "Correct for whom?" "Correct in what context?"

Completeness and comprehensibility, in their turn, demand that the supervisor/editor be certain of the purpose of the material he is reading. All communication, whatever the medium, has one or more of these purposes:

> To direct
> To inform
> To persuade

The writer must know his purpose as he writes; the supervisor, in his editing, must satisfy himself that this purpose has been met. In addition, he must determine whether the writer has planned his report so that its message is clear; so that "noise" has been eliminated or overcome; so that the needs of the intended audience have been anticipated. A report which does not meet all of these criteria is unsatisfactory for any purpose whatsoever. But once these essential requirements are fulfilled, the report intended for file or for circulation within the group is ready for release.

Many reports, however, are written for distribution outside the group (to management or clients, for example). Here again correctness, completeness, and comprehensibility are essential, but the supervisor/editor must also make sure not to release such reports until he has given proper care to the less essential secondary factors — grammar, style, format, and the mechanics (spelling, punctuation, and the like).

The supervisor/editor does no revision; he points out those changes which are to be made and explains the reasons for them. (Of course, difference in writing style between supervisor and author is not in itself sufficient reason: two styles may be widely divergent yet equally good.) Revision is done by the author, who then returns his work for further review. (Note that the author cannot very well revise unless the supervisor can state clearly and objectively why revision is needed.)

EDITING FROM SCIENTIST TO INFORMED LAYMAN

by Edward Hutchings Jr.
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An exposition of the problems of (1) getting "America's richest concentration of talents in fundamental science" (Fortune) *to write for publication, with some of the satisfactions accruing thereto, and (2) of establishing the level of understanding of the reader where the scope ranges from high school students to scientific leaders. Also included are six principles which make for readability.*

For the past dozen years I have been editor of a magazine called *Engineering and Science,* which is published by the California Institute of Technology. Since this is the only regular magazine put out at Caltech (it appears monthly, through the school year), it is something of an all-purpose publication. It goes to alumni, faculty, students, parents, and trustees, to individuals who contribute funds, and to industrial concerns that support research at Caltech, to high school science teachers and principals, libraries, newspapers and news magazines, and, finally, to a group of general subscribers.

This miscellaneous group of people (I make it sound pretty big; actually it is something under 7,000) has one thing in common — an interest in the California Institute of Technology, and therefore an interest in, and some curiosity about, the fields of science and engineering.

THE PURPOSE OF THE CALTECH MAGAZINE

These fields are the main concern of the Caltech magazine. Of course, like any self-respecting college publication, the magazine carries some news of alumni, of student activities, of comings and goings and developments on the campus. But it is primarily devoted to reports of research in progress at Caltech. And this reporting is done, whenever possible, by the men who are actually engaged in this research.

Once you have established this editorial purpose for a magazine you find that you are faced with almost limitless possibilities as to subject matter, not to mention a list of potential writers that, in another field, would be called a star-studded cast.

ABOUT CALTECH

Caltech is small but fully-packed. It has approximately 700 undergraduates, 600 graduate students, and 475 faculty members. About half the faculty is engaged primarily in teaching; the other half concentrates on research. Five faculty men have received Nobel Prizes; 36 of them have been elected to the National Academy of Sciences.

As far as students are concerned, Caltech accepts less than 200 freshmen each year, so each freshman class is made up of young men who have placed in the top 1 to 2 per cent of all students taking the College Board Entrance Examinations in the nation.

Caltech's brilliant faculty, therefore, is being constantly challenged by new waves of brilliant students. This results in such situations as the one in which the biology department worked out what it thought would be an ideal exam question to elicit long, thoughtful replies from the students. The question:

> "You have been sent by the National Aeronautics and Space Administration to outer space, and charged to report for each celestial body as to whether or not it is inhabited by living objects. How will you recognize objects as living?"

To which one student gave the curt answer:

> "Ask if it is alive. Even a negative reply should make you suspicious."

POTENTIAL WRITERS

At any rate, when *Fortune* magazine did an article on Caltech several years ago (September 1959), it reported that the Institute "harbors what is America's richest concentration of talents in fundamental science." These are the potential writers for a Caltech magazine. I said *potential*. The talents in fundamental science do not necessarily extend to communication.

RESPONSIBILITY TO COMMUNICATE

As a matter of fact, when I first went to work on the Caltech magazine, I was prepared for (1) a mass resistance to communication and (2) an inability to communicate in the cases of the few who might be willing. That was shortly after the war. A lot of the boundaries between science and nonscientific affairs disappeared during the war, and ever since then it has become increasingly clear that scientists would have to communicate intelligibly not only with each other, but with nonscientists as well.

Paul Saltman, a Caltech graduate who is now associate professor of biochemistry at the University of Southern California, said recently:

> "I think the real problem confronting scientists today is to fulfill the obligations of the scientist to society — the obligation to be creative in research, to grasp new knowledge and bring it forth for the utilization of mankind, and to be responsible for the communicating of this knowledge."

The old-fashioned scientist who stuck to his laboratory, published (reluctantly) for his colleagues, and the hell with the rest of the world, is pretty hard to find lately.

ABILITY TO COMMUNICATE

As to the *ability* of scientists to communicate the details of their work — I think I have seen better, and clearer, and more professional (and more interesting) writing by some of Caltech's scientists than I have in most of the articles written by science popularizers in the general magazines.

I don't know why this should be so surprising. Most of the Caltech men are teachers, after all. And teachers are in the *business* of communicating. Good teaching demands many of the same talents as good writing — including skillful presentation, an awareness of the nature of the audience, clarity, color, even a little ham.

WHAT MAKES THEM WRITE

In producing a magazine at Caltech, then, I have a collection of not-unwilling, and not-untalented writers at my disposal. How do I get them to write?

We are coming to the hard part.

No one has any spare time at Caltech. (Or anywhere else, generally.) And when anyone gets some he puts it on his research. A man may occasionally force himself to write a report on his work for the journal of his scientific society. But the simple fact is that there is no traffic problem in the editorial offices of the Caltech magazine.

We can't *pay* for articles, which is how the general magazines assure themselves of material. But money is not such a great incentive in this particular society anyway — as I found out one year when I decided to encourage Caltech undergraduates to write for the magazine. I set up a contest, with a $100 first prize and a $50 second prize for the best short articles. After an indecent period of time, no entries were forthcoming at all. I finally extorted a few entries from a group of journalism students by making a class assignment out of the contest.

What it comes down to is that the incentive to write for *Engineering and Science* is simply a man's desire, or willingness, to communicate — to explain something about the nature and purpose of his research. Of course, there are always plenty of men who resist doing this. I think, though, that once a man has written an article for the magazine, and experienced the results, he has usually become a fairly regular contributor after that.

As I said, *Engineering and Science* goes to an assortment of people. So a single article may bring a letter from a trustee, thanking the writer for finally letting him know what was the *point* in working with all those fruit flies and that red bread mold. A publisher will ask permission to use the article in an elementary biology text. A high school science teacher will ask for reprints for a biology class. A drug company will ask to run the article in their house organ. And a Mr. and Mrs. Smith will write to say that if all the articles in Caltech's magazine are as interesting as this, they'd like to subscribe, adding that:

> "We are both engineering graduates of Blank University, but our magazine is all football."

This kind of response — the fact that something you have written about your work has reached, interested, penetrated, and even affected so many unexpected kinds of people is, I guess, the main attraction to writing for this kind of magazine.

An added attraction, and a most important one, is the fact that, at the same time, a generally understandable research article lets a man's colleague's and men in other disciplines, know something of the nature and progress of his work. As our world — even the confined world of Caltech — gets larger and more complex, this becomes more and more valuable.

WHERE ARTICLES COME FROM

We track down articles for *Engineering and Science* in various ways. (*We*, I might explain, means a staff or 2-1/2 people—myself, an assistant, and a part-time secretary.) Sometimes we will get a man to revise a technical paper he has presented at a meeting of his scientific society, scaling the paper down to more general understanding. Sometimes we can get a man to write out an article based on a talk he gave at a departmental seminar. Sometimes, after reading official reports of research in progress in various parts of the Institute, we will ask a man to write up a general account of his work.

Probably the most complicated process of all is one we have been using with great success. This involves a tape recorder, a lot of effort, and not a little expense. This is the system we have to use for the busiest, hardest-to-catch men who, under no circumstances, will agree to take the time to write anything for us.

This is a procedure we invariably follow with one of our men — the theoretical physicist, Richard Feynman. Feynman is brilliant, volatile, and enthusiastic — and so there are constant demands on his time. There is no way to get an article from him but to wait for a time when he has been unable to escape some commitment for a talk — at the annual banquet of the American Physical Society, perhaps; or to an undergraduate assembly on the campus; or some other large and powerful group that, by superior size and weight and influence, has pressured him into making a public appearance.

As soon as we discover that Feynman has been trapped, we call him up. If he answers his phone at all (and he goes to a lot of trouble to keep from doing this), he is quite likely to start the conversation, not with "Hello," but with, *"Now what?"*

It is best to ignore this and to get right down to business before he hangs up, so you foolishly ask him if he is going to write out his proposed talk. His answer is all too clear — and he adds that he won't even know what he's going to say until he says it. Then how about making a tape of the talk? A tape? If we want. No difference to him.

So we tape the talk. And we transcribe it. And we send a copy of the transcript to Feynman. Now Feynman's reaction is the same (though perhaps a little heightened) as that of most other people faced with a direct transcript of what they have said in public. The transcript is a revelation to him — and an appalling one.

The fact is that communication by means of a talk or lecture has very little in common with communication through writing. When most of us speak, grammar goes by the boards, sentence structure is violated, sentences are rarely completed, repetition is rampant — by writing standards, it's a mess.

Nevertheless, we have had good success with taped talks. It is usually not at all difficult to get a man who will never agree to write an original article to spend twice as much time turning a transcript of a talk into an article. Sometimes I think it must be because the speaker is so shocked at the illiteracy of the transcript that he is willing to work it over for his own self-respect.

We have obtained some of our best articles in this way, and they have been on subjects that might never have been preserved or recorded in any other way. It is a time-consuming process, but often worth it. While a speaker works over one copy of a transcript, I usually edit another copy. We then combine corrections and revisions (which may take many hours), and a second version of the piece is typed. By the time we both work over, and agree on, this second version we usually have a good article.

THE LEVEL OF UNDERSTANDING

Once a man has consented to write for us at all, and we have agreed on the subject of the article, there comes the matter of the level of understanding at which the article will be written.

In *Engineering and Science*, I must admit, this level fluctuates from month to month, even from article to article. This is inevitable because every article is to some extent a compromise. While I do all I can to direct and edit the article so that it is as simple as possible, the author is often doing all *he* can to keep the level of understanding as high as possible. What is finally published represents the point at which this *particular* compromise reached its farthest limits on each side. Or sometimes, what is finally published merely represents the point at which time ran out on us.

In any case, the level of understanding we try to maintain in *Engineering and Science* is one that can be comfortably followed by that rare creature known as the informed layman. Of course, the greater part of the magazine's readers are Caltech alumni (about 4,000 of them), and it has often been argued that if they are anything they are *not* laymen. But we have discovered, instead, that they are usually laymen in all fields outside their own. They all share a background and training in science and engineering; but in the field of astronomy a geologist is usually a layman, in the field of mechanical engineering a biologist is a layman, and in the field of aeronautics a chemist is a layman.

In editing material for *Engineering and Science*, I try to follow the old dictum of never underestimating the intelligence of our audience while never overestimating their knowledge. Keeping in mind that our articles will be read by high school students as well as by the president of the American Association for the Advancement of Science, I am willing to take the risk of explaining too much rather than too little.

A CASE IN POINT

For example, several years ago we received an article on cosmic rays, which concerned some fruitful investigations made in the region of the north geomagnetic pole by Victor Neher, professor of physics. The article was written by one of Neher's students. It was a straightforward account of this particular research project, and it could have been printed pretty much as written. However, it would only have proved interesting, and understandable, to other cosmic ray workers and physicists. In broadening the article I think we made it of interest to most of the rest of our audience.

First, we got the writer to add an explanation of the advantages, or the *reason*, for studying cosmic rays at the geomagnetic poles.

This proved to be an essential part of the story, of course, but it had been ignored by the writer, who was so familiar with the project that it never occurred to him to go into such a basic detail. (The reason for studying cosmic rays at the geomagnetic poles? Well, the earth's magnetic field interacts with cosmic rays approaching the earth, just the way a magnet does on any charged particle that passes near it. This makes the particle move in a curved path, the radius of the curve being smaller as the energy of the particle is less. A particle coming toward the earth will be deflected and even sent back into space if it doesn't have enough energy to penetrate to the earth's surface. This bending effect is least at the geomagnetic poles and greatest at the equator. Only at the geomagnetic poles can cosmic rays of low energy come near reaching the earth. So it's an ideal place to study them.)

We added one other thing to this article — some lead paragraphs that described what cosmic rays were, and that *reminded* the reader of the purpose of cosmic ray research in general.

I think the resulting article was a respectable and an informative piece of writing, and I don't believe anyone considered it condescending. At any rate, the first few sentences of the article will give you a sample of its tone:

> "Cosmic rays are invisible but powerful charged particles that constantly bombard the earth's surface. They are so numerous that at sea level about 10

particles will pass through a person each second. Their energy is so great that they are found even at the bottom of the deepest mines, having penetrated hundreds of feet of rock.

"The most powerful of these rays has a thousand billion times as much energy as is released from a single uranium atom in an atom bomb explosion. Our biggest accelerators today produce particles of about five billion electron volts, but cosmic rays have energies as high as a billion billion electron volts. In fact, the energy reaching the earth in the form of cosmic rays is roughly equal to that reaching the earth as starlight (excluding our own sun, of course). Geological evidence indicates that cosmic rays have continued their bombardment of the earth for at least 35,000 years, and studies of meteorites indicate that they have been bombarded by cosmic rays for hundreds of millions of years."

Cosmic rays have been studied, however, for only about the last 50 years. . . .

I submit that this kind of writing is more effective than the following lead paragraphs of an article from another college engineering publication which is also devoted to cosmic rays:

"Since 1958, the Cosmic Ray Group of the Blank University Physics Department has been engaged in high-altitude investigation of cosmic ray activity. Professor R. R. Arp, assisted by graduate students and technicians, has received the cooperation of the Geophysical Institute of the University of Alaska at Fairbanks in performing research using systems similar to the one described here. The author joined this Cosmic Ray Group in 1959 and wishes to thank Professor Arp, C. D. Bix, D. P. Ott, and W. B. Haur for their help in familiarizing the author with the problems under investigation.

"A debt of gratitude is owed Mr. Jones, Professors E. R. Smith, H. J. Brown, and T. E. Green for their suggestions during the preparation of this paper. W. S. Evans generously offered to prepare the drawings.

"Increased interest in satellites and upper atmosphere research devices has motivated engineers to seek lightweight, reliable telemetering systems. This paper presents a block diagram of telemetering circuitry employed in a balloon-borne system used to study cosmic ray activity at high altitudes. A detailed discussion of an unusual circuit incorporated in the transmitting system is included. . . ."

I don't make this comparison because one sample is so great the other is worthless. I make it to show that, in the first case, the material has been prepared and presented in the hope that it will be read. In the second case, the material just lies there; it's a matter of take it or leave it. And I think I know the choice most of the readers of that magazine made.

Writing, in any form, is such hard work that it seems wasteful not to try to make it as readable as possible. As far as *Engineering and Science* is concerned, these are some of the things we think make for more readable writing:

1. Defining technical terms. Even though they are thoroughly familiar to the man in one particular field, they are often unfamiliar to (or forgotten by) those outside of that field.
2. Not stopping at a straight description of a research project, but making some attempt to explain briefly where this work stands in relation to other work in the field.
3. Giving a man's first *and* last name, his title, or even a descriptive label. (Not just Jones but Dr. Eric Jones, the Boston radiologist; or Adam Smith, professor of chemistry at the University of Oregon.)
4. Getting some of the human side of research into an account of a research project when it is possible or pertinent. There is a long tradition of third-person style in scientific writing, but some of the greatest scientific writers of all have *been* great because they admitted that human beings were involved in the work they describe; it didn't just happen.
5. Trying to present articles in such a way that people will be *encouraged* to read them. Open layouts, liberal use of white

space. Good-sized pictures. Adapting some of the general-magazine practices of headlines and "decks." Shortening sentences and paragraphs. Cutting down on footnotes and references when possible, and incorporating such information into the text.

6. Writing as *simply* as possible. (There are still some durable people who think that good writing is *fine* writing, that a scholar should have his diploma taken away if he writes anything that might be understood by, or — heaven forbid, might be of interest to — a layman. They confound their readers with "the former" and "the latter" rather than repeating a word. They interlard their writings with phrases like, "To deal with these items further is beyond the scope of this work," instead of simply not dealing with those items further, and shutting up about it.)

Some of these things are supposed to be anathema to scientists. I have not found this to be true. *Engineering and Science* is not trying to do the job as a strictly technical publication. There, the purpose is solely to present factual information. What *Engineering and Science* is trying to do is help fill the need that was recognized by the AAAS in 1951, when it said:

> "It is absolutely essential that science — the results of science, the nature and importance of basic research, the methods of science, the spirit of science — be better understood by government officials, by businessmen, and indeed by all the people."

Of course, I don't often think of my job in such lofty terms. As editor of a magazine like *Engineering and Science*, which tries to bring scientist and layman together, I feel more like the operator of a lonely-hearts club. I happen to know these two nice kids. They're willing, but they're shy, and they don't know each other to well. I'm trying to promote a match.

EDITING THE SCIENTIST FOR THE STUDENT

by Edward A. Shaw
University of California Press
Berkeley, California

Mr. Shaw goes into the problems of editing textbooks on the undergraduate college level, taking a hypothetical manuscript and describing the stages through which it passes in becoming a textbook. Editorial problems peculiar to science textbooks are discussed.

Editing the scientist for the student means editing the textbook written by the scientist.

Any textbook is basically a source of information, usually written to meet the needs of a particular course at a particular level of instruction. Today there are science textbooks for elementary, junior high, high school, college, and graduate courses. Since I have never edited textbooks below the college level and since editing graduate textbooks actually amounts to editing the scientist for the scientist, the following comments apply to undergraduate texts, and especially to texts for lower-division courses. In material covered and in sophistication of presentation, the lower-division science textbook does not differ too much from the textbook used in high school courses. Both are intended as introductions to their subject. In fact, college texts are being used in some of the science courses in the better high schools, the main difference being that the college student is expected to cover the ground in a shorter time. But the scope, purpose, and direction of these introductory textbooks vary greatly, and the editor must have some knowledge of these variations and the reasons for them.

Most of these textbooks are written to meet the needs of a particular course, and a certain group. For example, one introductory chemistry textbook may provide a rigorous introduction to chemistry and a solid preparation for the following chemistry course; another may be a watered-down introduction to chemistry designed to satisfy the science requirement for liberal-arts majors; still another may provide a complete but cursory survey of the entire field, satisfying the needs of the student who will go no farther, yet preparing the chemistry major for the next and more specialized course. A calculus-1 textbook may be intended particularly for mathematics majors, stressing theory and preparing the student for more advanced courses; another may be intended for engineers, emphasizing practical applications and minimizing the theoretical background.

One textbook may be a self-contained unit, supplying practically all the information required by both the student and the teacher. This textbook would theoretically provide the student with all the information necessary to understand the subject without the aid of a teacher. Another textbook for an identical course may be intended to serve only as the scaffolding from which the student can work on the material presented by the instructor. The textbook *plus* the lectures will supply the information needed for the course. Unless the editor knows the intent of the author — the kind of course, the kind of student, the kind of instruction he has in mind — he has no way of knowing whether his text gives incomplete coverage or goes into too much detail, whether the seemingly verbose sections need pruning or the sections in which too much seems taken for granted need expansion.

Most authors of science texts are scientists who are teaching, or have taught, the course for which they write the textbook. Although practically all of them are experts in their fields and are experienced teachers, not all are expert writers, and not all are familiar with the processes involved in transforming a manuscript into a published book. Before turning to the editing of the various parts of the manuscript, I should like to make a few remarks about the pre-editorial history and about the physical characteristics of a hypothetical (but not too hypothetical) manuscript.

Any resemblance between the following manuscript and the one you happen to be working on now is purely coincidental.

PRE-EDITORIAL HISTORY OF A HYPOTHETICAL MANUSCRIPT

This manuscript has been written over a period of two or more years. The author, a busy science teacher, has worked out an outline and then a rough draft during the school year: probably as a subconscious revenge on his students. Revising, rewriting, and polishing have been done during the summer. After a second typing, revision of several chapters, and a complete rewriting of the first two chapters, what the author believes to be the final draft is ready. He now has his wife check the grammar and see how the manuscript reads. He then shows it to his friend and colleague down the hall, who has the impertinence to make a couple of suggestions. After rejecting these suggestions, and removing the punctuation his wife has inserted, he submits the manuscript to the publisher.

The publisher may then turn the manuscript over to one or more experts, usally persons teaching courses in the subject, for critical reading. They check the manuscript's scientific accuracy, see if the author has used the standard methods properly, and decide whether they could use it in their courses. They then return the manuscript to the publisher with minor or extensive criticisms. If the criticism is severe, the publisher may reject the manuscript. If the criticism is not too extensive, the publisher may return the manuscript to the author and ask him to consider the changes or revisions they have suggested. (If they have no criticism to offer, the publisher immediately checks to determine if they are cousins, nephews, or at least brothers-in-law, of the author.) The criticisms of our manuscript were minor, the author made most of the changes suggested and explained why making the others would have been absurd.

The manuscript is now ready for the editor, who, as we have seen, receives the manuscript with the endorsement of the author, the author's wife, and author's friend and colleague, and the expert readers. The consensus is that this is a masterly conceived and executed manuscript which will require only a few minutes of editorial scrutiny and marking before it's ready for the printer. But — for the first time since the manuscript was conceived, it is being examined by an objective, careful, trained reader, whose purpose and responsibility are to see that the manuscript is in every way ready for the printer. No one, not even the author, has read the manuscript with the thought of being responsible for it in every detail. (Don't forget that he left the correction of his grammar to his wife!) For the first time, also, the manuscript is being considered from the student's point of view.

The editor reads the preface in the hope of finding what the book is all about, skims through the text, and then begins editing. This time the manuscript isn't being checked by the author, who failed to realize that the techniques he used to explain difficult ideas in classroom lectures do not convey his meaning to the textbook reader. This time the manuscript isn't being checked by the author's wife, who somehow failed to notice that every other page contains a sentence with a split infinitive, dangling participle, or misplaced modifier. (A science course may not be the place to teach English, but neither is it the place to undo what the teachers of freshman English have tried to do.) This time the manuscript isn't being checked by the colleague down the hall, who somehow neglected to notice that the graph on page 16 doesn't agree with the table on page 75, and that neither the table nor the graph agree with the data used in the formula on page 500. This time the manuscript isn't being checked by the expert, who knew that the conclusion stated on page 50 was correct in spite of the fact that a vital step in the preceding argument was missing.

Physically the manuscript is, to use a euphemism, a challenge to the editor. It stands about a foot high, is typed on three different kinds and sizes of paper, and seems to have about a thousand pages — seems, because the pages are not numbered consecutively. A third of the manuscript has been typed single spaced by Aunt Susie on onion-skin paper; one-third has been typed triple spaced by the author himself on corrasable bond; one-third is double spaced mimeographed copy prepared for use as a syllabus. All heads and subheads are typed the same way, so that it is virtually impossible to determine their ranking. Corrected and revised paragraphs have been retyped and stapled to the page, or, worse still, pasted down with Scotch tape. There are interlinear and marginal changes in ink in three different hands, all illegible. No editor ever has or ever will receive a manuscript like the one described here, but we have worked on manuscripts with some of the preceding physical handicaps.

Now let's look at the parts of the manuscript and a few of the editorial problems each one poses. To start at the back and work forward — to have our appetizers before the main course — we find that the manuscript is made up of the index; the footnotes which we have had to ask the author to type on separate sheets; the bibliography or references; the questions or problems; the tables; the illustrations, including graphs, drawings, and photographs, and their legends; the text proper; and the frontmatter (this we can call dessert, because it usually is easiest to take).

INDEX

A science textbook should have an analytical index, and the entries and subentries should indicate the relationship of the topics. The textbook is a source of information, and the index is the means of locating that information quickly. To slight the index is to impair the usefulness of the book itself. Even the best textbook may be spoiled by a poor index.

Although the author should know better than anyone else what should be included in his index, few authors have the experience or the time to prepare a good index, or want to spend the money to hire a professional indexer. Moreover, the index may not receive the careful editorial attention that was given to the rest of the manuscript: It can't be completed until after the page proofs are out, and both the author and the editor have their hands full trying to meet the printer's schedule and have the book ready in time to be considered for adoption as a text in as many schools as possible. But if he has time, the editor can eliminate needless duplication and repetition in cross references, can check to see that actual subjects, not obscure modifiers, are the main entries, and can arrange the entries and subentries, by judicious consolidation, to show the general relationship of topics.

FOOTNOTES

The fewer footnotes in the introductory textbook the better. There are places where a footnote is an absolute necessity, but there should be very few of these places in a lower-division textbook. The beginning student may find that footnotes hinder him rather than help him.

The editor is usually able to suggest to the author ways in which footnotes can be incorporated into the text; often he is able to convince the author that he should omit them altogether. The footnote which documents information can usually be incorporated into the discussion in an abbreviated form without too much trouble. The footnote which contains information not directly related to the discussion should be considered for deletion if it cannot be worked into the text.

BIBLIOGRAPHY OR REFERENCES

There seem to be almost as many bibliographical styles as there are books. In my opinion, the editor of the science textbook is shouldering an unnecessary burden if he tries to change the author's bibliographical style. If the author's style is consistent, and if the entries contain all the necessary information, then his style should be used. Forcing bibliographical references of one style into the rigid mold of another style can become time consuming and frustrating. Beyond making the entries consistent, the editor's main bibliographic duty probably consists only of convincing the author that a long bibliography may be more discouraging than encouraging to the beginning student.

QUESTIONS OR PROBLEMS

Many textbooks have questions or problems at the end of each chapter. Since these questions are devised by the author and used by the teacher to force the student to acquire a working knowledge of the information in the chapters, their importance cannot be overemphasized. The meaning of each question or problem should be crystal clear, and although grammar or anything else that stands in the way of clarity should, in my opinion, be sacrificed, it is usually true that deviation from good grammar and standard syntax are the basic source of ambiguity.

TABLES

A collection of data arranged in columns is not necessarily a table. The true table shows the significance of the data it comprises, and the relationships among them, more clearly and concisely than they can be shown in words. It is a particularly suitable form for presenting scientific information, but, like a poorly worded sentence, it can be ambiguous, confusing, or misleading. Tables are an indispensable part of the science textbook. They deserve as much editorial attention as any other part, and probably require more.

An editor soon learns to be suspicious of tables that have excessively long titles, columns without heads, column heads that do not describe the material in the columns, stubs that contain items that belong in different categories, or many footnotes. Any one of these may be comparatively easy to revise, any one of them may even prove to be necessary, but more often than not their presence, alone or together, is an indication that something is basically wrong with a table. An author can generally remake a table, or divide an excessively complicated one into two or more smaller ones, when he has been shown what is wrong. But only when he has been shown. And who shows him? The editor.

ILLUSTRATIONS AND THEIR CAPTIONS

An illustration is an integral part of a textbook: if it isn't it should be eliminated. This may sound like a truism, but it is often difficult to convince a beginning editor that he must always check all figures, plates, diagrams, charts, and maps against both their legends and the text. There seems to be a natural inclination to "leave the illustrations to the designer." Yet if a map shows a town on the west bank of a river and the text says it is on the east bank, if a legend reads "Bone artifacts" and the illustration depicts a single bone awl and a series of flint arrowheads, or if it is necessary to insert an errata slip saying "Magnifications given in legends for plates 17, 23, 46, and 92 should read X4, not X8," it is the editor who takes the blame — and rightly so.

TEXT PROPER

Which brings us to the text proper. This, the major part of the textbook, gets the major part of the editor's attention. Although the editor cannot be held responsible for the scientific validity of every statement in the textbook he is editing, he should check, from his own knowledge and from other sources, the accuracy of any statement that does not seem reasonable, or should at least query the author, who, when his attention is called to a misstatement of fact, a contradiction, or a complete ambiguity will probably decide that the passage questioned is "really not necessary" and delete it, rather than rewrite it. He examines the logical development of the author's presentation for gaps or discursions that would confuse or confound the student, provides stylistic consistency when it is lacking, eliminates overuse and misuse of words (being careful that he does not overuse a few of his own pet pat phrases), and so forth. He tries to help the author achieve the most effective presentation of material, and, in short, does everything he can to make the manuscript into a book that will be the masterpiece the author has known it was from the beginning.

To talk to writers and editors about the actual details of editing, if it did not consist of what Norman Douglas called "dissecting the obvious," would probably lead to a charge of inciting to riot, since no two, let alone (the number present) seem ever to agree on what the really fine points of editing are. Consequently, I'm going to mention a few of my pet peeves, and then mention briefly a couple of the reasons for some of the editorial problems peculiar to the science textbook. The opinions I express are my own; any errors of fact are directly attributable to my wife's errors in typing.

Pet Peeves

First: — The self-imposed, but universally imposed, limitation to the use of one tense and to one person, third-person objective, in science textbooks is too severe a restriction. If possible, only one tense should be used in one paragraph, but even this, I believe, is not always possible. The use of the third-person — "the writer, the author" — is less objective than objectionable and is often ambiguous. The use of the first person is not only perfectly acceptable but is also perfectly clear — "*I* wrote the book" — not some shadowy, shady, third person who can presumably be blamed for the tedious writing that results from the use of only one person and one tense.

Second: — Without creative writing, without experimental writing, our language would stagnate, but the science textbook is no place to experiment with new styles in punctuation and grammar. Clarity of meaning is the primary consideration in the textbook, and the present-day tendency to use as little punctuation as possible (largely a tendency that has developed because no one bothers to learn the rules) is one that must be avoided when presenting new and difficult material to young students. The rules of punctuation and grammar have become rules because they are aids to intelligibility; don't discard them until you have something to take their place.

Third: — The use *of et al., e.g., i.e., loc. cit., op. cit.*, and other Latin abbreviations should be eliminated or, at least, kept to a minimum. Too few people, including authors, seem to know what these abbreviations mean or how to use them. There are perfectly good English words that can be used instead of these Latin abbreviations, and they will be understood by every reader.

Fourth: — After putting this down I decided that I had better see how many peeves I really had. When I reached 37 I gave up, but I'll spare you all that and go on to the:

Reasons for Some Editorial Problems Peculiar to the Science Textbook

Most science textbooks are written by scientists who are also teachers. Although the fact that the author is both a scientist and a teacher isn't, to be slightly (but only slightly) facetious, a double handicap, the author's experience as a classroom lecturer and his expert knowledge of his field can actually become obstacles in writing a textbook for a lower-division course.

Many, if not most, textbooks are based on material the authors have prepared for their classroom lectures, but there is a difference between a series of good lectures and well-written textbooks; and it may be difficult for an author to make the transition from lecturer to writer. Many of the techniques used to convey meaning in a classroom lecture are impossible to duplicate in a textbook where the written word alone must carry the full meaning.

The missing steps in arguments, the incomplete explanations, the gaps in logic, and similar deficiencies that may be so evident in a manuscript were obviously not present in the classroom lectures, or the author would never have established the reputation that makes him think his text will sell. In the lectures, gestures, parenthetical asides, a quick sketch on the blackboard, the answers to students' questions, and any number of other techniques filled the gaps, provided the steps, completed the explanations. As he sits at his typewriter our author raises his eyebrows, shrugs his shoulders, and sketches an outline drawing in the air with his forefinger (the one he isn't hunting-and-pecking with), but unfortunately there is no way of getting these into the manuscript. Then, when the manuscript goes to an expert for a critical reading, he fails to detect the deficiencies in the manuscript because he, like the author, is a teacher who thinks of the text as an outline for a series of classroom lectures. The manuscript may contain all that a good teacher requires for understanding, but may leave the student completely mystified.

A manuscript based on lectures may, paradoxically, also contain much that is superfluous. The introductory review at the beginning of each lecture, and the closing summary at its end, may be very helpful in the classroom, but completely unnecessary in the textbook. Two lectures may be interrupted by a day or two, a weekend, or a week-long vacation, and a short review of preceding material may be a useful way of bridging the time gaps. In the textbook, however, the text is developed in a continuous discourse, and a permanent record of preceding material is contained on preceding pages. Much of the repetition used in lecturing is completely out of place in the textbook. The "as I said before," "as mentioned earlier," "as we have seen," or "as will be shown later," may be effective ways of reminding a *listener* that a subject has been mentioned earlier, of indicating why another subject is covered only sketchily, and of tying together material covered in different lectures, but may give such a condescending tone to a textbook that the student becomes offended and refuses to read farther.

The jargon of science, in which the author writes so well for his colleagues, cannot be used in the beginning textbook until it has been properly introduced. New terms should be clearly defined as they are used, and concepts must be explained in terms the student is capable of understanding. The expert, with twenty or thirty years' experience in the field, is likely to forget — at one time or another he is sure to — that words that have a specific meaning for him may have an entirely different, more general, meaning to the layman. In editing the scientist for the student, the editor questions anything that does not seem clear and understandable to him. If the editor has difficulty understanding a passage, it is reasonable to assume that the student may also have trouble with it.

FRONTMATTER

And now, in reading our manuscript from back to front, we come to the frontmatter, the material preceding the text proper. This may include a foreword, preface, introduction, or some other prefatory statement, and always a table of contents and a title page. The editor, as well as the reader, looks to the frontmatter for guidance. Here he should find some helpful explanation of why and for whom the book was written, the purpose and goals of the book, the topics that are stressed or minimized, the way in which this book differs from other books on the same subject, and any other outstanding characteristics that may determine the kind of editing the manuscript requires. The table of contents may often serve as an outline of the book, and help to determine the relation of the various sections to one another — a relation that may not be evident in the manuscript itself. The preface, or foreword, or introduction (some books have all three) are important for another reason: they are the parts most likely to be read carefully by reviewers and by teachers who may be considering the book for adoption in their courses. Hence they are no place for vague statements, explanations of the book's deficiencies (even when it has them), or irrelevant comments on how difficult it was for the author to write the book. A book gets published because it has certain merits; this is the place to state them. The editor checks the frontmatter twice, once when the editing is started and again when the editing of the manuscript has been completed. As it now has.

I said earlier that the opinions I would express were entirely my own. Now, to be fair, I think that any conclusions that are to be drawn should be entirely *your* own. If one of them should be that I believe that an editor can — sometimes, at mediocre manuscript: well, you're probably right.

EDITING REPORTS FOR THE SEMITECHNICAL ADMINISTRATOR

by J. Campbell, Jr.
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In writing to inform administration the author discusses the importance of (a) appearance and format, (b) a clear statement of purpose and content, (c) pertinence of details, (d) adequacy of explanations, and (e) effective presentation of points.

At the risk of sounding trite, let me start off by saying that I believe the report to the administrator is usually the most important of all the reports from the scientist — it is bread-and-butter. The scientist or the engineer may be the one who develops the ideas and facts that underlie the decisions and plans of the administrator, but no matter how much he prides himself on the values and importance of his ideas, it is still up to the administrator to make the decision and accomplish the realization of the ideas or recommendations. Thus, the scientist and the administrator are two key members of a team: the first furnishes the technical foundation, and the second applies to that foundation the resources and machinery of business.

This simple analysis of the relationship of the scientist and administrator to each other indicates that a report to an administrator must "make a sale" if it is to do any good. And so I take the premise that the purpose of the technical report to the administrator is to sell the administrator on the factual story or on the advisability of making a certain decision. It is not sufficient for the scientist or engineer to assume that his report will be automatically considered and carefully weighed by management simply because the originator knows that the idea is sound and valuable; he must present his report in such a way that it draws and commands as much attention as it deserves.

Administrators generally consider themselves as people whose time is at a premium, who can't waste time with anything unimportant. Whether you think this vanity is justified or not, you as an editor (and your time is valuable too) have a responsibility to save the administrator from wasting time in trying to unravel poorly prepared reports or even a good report written in language he can't understand. Since we know that such reports stand little chance of consideration, it is your responsibility to prepare the report in such a way that the administrator will feel that he is not wasting his time trying to understand it. If you can do that — if you can prepare the report so that it is clearly understood and duly considered — you have earned your pay no matter which decision the administrator reaches.

This goal of acceptability is easiest to attain if we take a few tips from the psychology of selling and from the fundamentals of business administration.

THE FIRST IMPRESSION

From the selling standpoint, remember that we must attract and hold favorable attention. This is not automatic — we must create something that will bring it about. Impressions begin with the first look at the report. It may be too strong to say it is love at first sight or not at all; but I believe it is true that if the first impressions are unfavorable, the administrator is not going to change his opinion.

Now, although this discussion is aimed primarily at the content of the report, I think we ought to start with the appearance because that is the first glimpse the administrator gets of the report.

All too many times a report fails to accomplish its objective because the format is not attractive, or the typing is not smooth and regular, or because the pages are not sharply in line when stapled. Perhaps the covers are not suitable. I am not implying that administrators are excessively fastidious; rather, I am saying they are usually very alert people and are likely to be greatly influenced by the general make-up of the report.

I do not wish to belabor the matter of mechanics, but it *is* a responsibility of the editor, and it is too often considered of minor importance. There is an abundance of professional material and help on matters of format, but we may summarize a few of the important points. We should ascertain, if we can, the type or style of format that the administrator prefers. We should determine whether the presentation should be run-of-the-mill, or glossy, or extra plush. The presentation should fit the particular need it is to meet. We should know the number and type of people who will see the report before it has finished its rounds, and we should select the method of reproduction and binding that is appropriate to those needs. In proportion to the size and value of the over-all project involved, we must determine whether to use an expensive format or be as economical as possible. In all these matters, whether we are preparing a single-page memo or a volume, we *must* provide something pleasing to the eye. Remember what that first glimpse can do.

A STIMULATING INDICATION OF CONTENT

Now if we have created a favorable impression at the start, how do we hold that attention? The first step was external, the remainder is internal; it has to do with the content of the report. We assume that the administrator, our prospect, has been attracted, at least not repelled, and he is now going to start reading the report.

Notice that I said he is going to *start* reading. What guarantees that he will *continue* reading? Provided the subject is of value, it is the *editor* who can guarantee that he will continue to read. This seems to be a large order, so let's break it down.

I mentioned that the administrator is a busy man and does not want to waste his time. Now why would he want a report and be willing to take time to read it or listen to it? Usually he is looking for technical information in the report for one of at least three reasons: he needs technical information for a status or progress report, or he needs technical information to pass along up the line or at a conference, or he needs technical information to crank into his own mental machinery with all the other data that will produce a decision.

If, then, for the administrator there is a purpose to the report, the editor must make it a primary point to indicate that purpose as soon as possible. After all, the purpose is going to tell the prospect *why* he is supposed to read. About the earliest point at which purpose can be indicated is in a title. Now don't pick titles in the manner of Earl Stanley Gardner; he writes mysteries and his titles just don't give away anything. The type of title *you* want might be "Status of the Maser Amplifier for Project Echo" or "A VLF Communications System" or "The Benefits of Using Synthetic Quartz for Frequency Control." You get the point; and so will the administrator. To emphasize the point further, compare the effectiveness of these two titles:

> "Manufacturing of Semiconductors"
>
> or
>
> "Evaluation of the Grown-Junction Process in Manufacturing Semiconductors"

The second title tells the administrator whether or not he should read the paper. If there is no title, see that the prospect has the purpose tossed to him in the opening sentence. And that sentence can easily start with "The purpose of this abstract is to ——" or "This report covers the developments of the Blank process in the first quarter of 1961."

POSITION OF CONCLUSION

After we have announced purpose, we weigh the second point in our arrangement: is it desirable or advisable to forecast the conclusion? I put this as a question because it can sometimes be debated. The editor should be candid enough to discuss this question with others if there is a reasonable doubt. Let me illustrate:

You know that Mr. Blank is proud of having originated the Blank process but you have to edit a report that proves his process is wasteful and outmoded. The report is going to Mr. Blank. Good luck and goodbye, this is where I came in! Anyway, I do not believe Mr. Blank will read a paper that starts with "The purpose of this report is to show that the Blank process must be abandoned." But he might read a paper that starts with "The purpose of this report is to re-evaluate the Blank process." I admit that that is baiting him, and the inevitable conclusion will be held to the very last paragraph, but at least there is a chance that he will read and be persuaded. At any rate, the latter approach will stall off your dismissal for a while.

Aside from such a fearful example, it is most often advisable to forecast the conclusion in the title or in the opening paragraph. Such a device will slant the entire report and will channel the administrator's mind into the direction needed. Once again, we are not writing detective stories, and the administrator has every right to know what we are up to.

We should admit that the editor has no authority to alter the facts of the matter. But the editor should have authority to *arrange* the facts of the matter, and he has an obligation to make the best possible arrangement to clinch the sale. A report may be compared to a piece of sculpture: be sure you take away all the marble that has to be removed, but be sure that what you leave is in the right places.

Whether or not the opening paragraph of the report states the purpose of the report, the editor should write a brief paragraph on a separate piece of paper giving a capsule summary of the purpose. Such a summary, kept always in mind, is a valuable guidepost not only toward the arrangement of the material, but also to the decision for including or excluding details. One often wishes that the original writer had clearly and concisely stated his purpose; it would certainly prevent much of the rambling that we encounter time and again.

Now after we have clarified our topic and crystalized our purpose, we should be fairly certain that our report will stay on the right track even if we have to go back to the originator and request additional track to reach our destination.

EFFECTIVE ARRANGEMENT OF MATERIAL

Next, there are some fundamental principles of arrangement that must be followed so that the reader's mind can readily grasp each idea being presented and understand how that idea applies to the over-all purpose.

I believe, and my belief has been questioned, that a technical report to the administrator must follow a pattern of presentation in the same sequence in which the administrator's mind operates. Although each individual may have certain peculiar whims or habits in his approaches to a problem, it is just as true that most individuals follow a rather uniform rational process.

What we have developed so far follows the usual sequence of mental behavior: every individual must form some impressions the first time he encounters a new idea or object, and we have tried to make those impressions pleasing; anyone who has to read a report will want to know quickly what the report is about and what it is going to prove.

Now, what other steps must we follow as we go into the body of the report?

We are trying to make the reader understand a desired conclusion even though it may not be practical for him to put the conclusion to use. For him to understand the conclusion there must be an orderly presentation of the same data, or at least a sufficient amount of the same data, that convinced the originator of the soundness of the conclusion.

The over-all conclusion rests on a number of separate but related ideas, each of which in turn may rest on separate but related ideas, and so on, until we get down to the bare specifics. Now it becomes the editor's job to arrange these ideas in logical groups as evidence in support of the conclusion.

There are various ways of presenting the evidence and conclusion: a conclusion can be stated and then followed by the necessary amount of evidence, or the conclusion can be stated and allowed to stand without evidence if it is believed that the reader will accept the conclusion. Then again the sequence may be reversed with evidence preceding the conclusion. I believe all of us know that a variety of arrangements is desirable, but what many writers and editors do not seem to grasp is that the little pieces called evidence and the little pieces called conclusion must be distinguishable from each other. All too often the writers, knowing perfectly well what part is evidence and what part is conclusion, fail to make the difference recognizable to the reader. The writer may believe very firmly what he is trying to prove and yet may leave the reader baffled and then think that the reader is stupid for not accepting the conclusion. On the other hand, because our reader is an intelligent semitechnical administrator we must not bore him with childishly simple syllogisms like "all cats are mammals, Tabby is a cat, therefore Tabby is a mammal"; even though the relation of evidence to proof had better be there and had better be just as convincing as the argument about Tabby.

If you as an editor cannot be positive that you can follow the patterns of logic and spot the very common fallacies, and sometimes these are deliberately planted in technical reports, you had better work your way through a textbook in logic. You can be sure that the average administrator has a good nose for logic even if he never read the book.

A more difficult trail to make clear throughout the course of a technical report is the continuity or thread that links all of the separate components into the entire structure. To keep that thread clearly in sight we must remember that throughout the course of the report many of the conclusions or minor ideas are in turn premises or evidence of larger ideas and so on. The fact that a statement may be a conclusion when looked at from one direction and a piece of evidence when looked at from another direction is the cause of some of the confusion that often appears in technical report writing. There is no denying that weak logic or weak logical construction will not coincide with processes of the administrative mind, and the administrator cannot take the time to reconstruct an argument. If *you* can understand and easily follow an argument that is presented to you, you can easily remember it and repeat it in your own words to someone else. I challenge you to explain something that you have heard if you were unable to follow the logic of the presentation. Just remember that the administrator's mind is very much like yours.

I cannot conclude this subject of editing without emphasizing that the terminology and the technical concepts must be kept within the level of understanding of a semitechnical person. Words that may be commonplace to the scientist are not necessarily familiar to the administrator, and some of the laws and processes familiar in the laboratory are beyond the grasp of the administrator. However, we sometimes find it absolutely impossible to avoid using some unfamiliar technical words or concepts. When that condition is encountered, be sure to provide definitions that are sufficient to give a fair idea of the meaning even if the definitions are not technically complete. It is also highly desirable, even commendable, to use illustrations out of everyday commonplace experience because such illustrations are vivid to the imagination of the reader. You probably recall that your most effective teachers in school were those who could give you vivid comparisons.

It is my feeling that adherence to the principles that I have been talking about is mandatory in editing a technical report for the semitechnical administrator. In the textbooks on the subject, I find that many many other details and principles are highly proclaimed. For the most part you can take them or leave them and it won't make much difference in terms of what the report will accomplish. But if you fail to understand and to aim at the almost subconscious mental habits of the administrator, the report you edit is almost certain to run into difficulties.

For convenience I should like to list a few questions that will serve as a checklist to determine whether the report you have edited has a good chance of favorable attention and careful reading by the administrator.

1. Is the general appearance of the report pleasing to the eye?
2. Is the format adequate and fitting for the distribution required, for the levels of management who will see the report, and in keeping with the economic importance of the project and content of the report?
3. Is the topic or subject quickly and prominently displayed?
4. Is the purpose of the report made known as early as possible?
5. Does the report stick to its purpose from start to finish?
6. Does all the information contained contribute to the purpose and is it clear how all details fit into the pattern?
7. Can any details be discarded as surplus even though they fit in and seem to be very appropriate?
8. Are there any terms or explanations that would require an expert to grasp?
9. If someone else reads this report, is there a good chance that his summary sentence of it will be practically the same as yours?

PANEL 11 — "QUICKLOOK - TECHNIQUE" APPLIED TO TECHNICAL FILMS

INTRODUCTORY REMARKS FOR THE PANEL OF TECHNICAL FILMS

by Robert B. Steel
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"Show Me!" As an introduction these words appropriately describe the requirements of technical publications, a current training director, and the audio-visual aids. Discussing the preparation and use of film strips, motion pictures, and video tape, the speakers of this panel were asked, "Show Me!"

"Show Me!" Eliza Doolittle's plaintive cry from the famed Broadway show, "My Fair Lady," makes a clear demand that might be made of today's technical writers and publishers. We are faced as an industry with many serious problems. One of the most vital problems concerns our technical manuals, which are slow to develop, laboriously written, and oftentime obsolete before they are out in the field ready for use. Devoted as we are to "words, words, words," many of us find ourselves today as 'elpless as 'Enry 'Iggins if we are asked to communicate in anything but verbal or printed terms. We seem to have forgotten the fact that most of our technical publications are used by our military and commercial customers for training purposes. Tackling these monolithic technical training problems with no other communication medium except words is a little like trying to carry on a scintillating romance in Morse code.

While Eliza Doolittle has something else in mind when she pleads, "Show Me!" the technical training director today finds that, of all the techniques of nonverbal communications, visual communication is the most reliable for training purposes. Developing our customer's ability to communicate visually as well as verbally will be one of the most effective services we can render him in his present hour of need. For the training director must slug his way through the collective mental block that confronts him at the beginning of each and every training period, and it is then that he needs to have at his fingertips every means of communication available.

Visual or graphic eloquence is more than an ability to draw or to use audio-visual aids effectively; it is the ability to invest lines, shapes, colors, and arrangements with meaning, so that they can become conveyors of intelligence, crystallizations of ideas, and movers to action. Our visual eloquence hinges not so much upon our native talents as draftsman as upon our understanding of the basic principles underlying graphic communication. The technical data industry is slowly awakening to the fact that words alone will no longer suffice. The technical manual, good as it may be, must now have visual aids to support it in training. I believe that these aids will use various visual techniques, many of which we will discuss briefly on this panel meeting. A good example of a visual technique is offered in video tape, which will be discussed later by Mr. Fierman and Mr. Kemp. Also, the motion picture offers an excellent supplement to the technical manual. This will be discussed by Mr. Baker and Mr. Roberts. But regardless of what visual means are used, sound or silent motion picture films, film strips, slides or video tape, statistics show that there has been a steady rise in the use of audio-visual techniques by government, religion, education, and business. The latter representing the greatest portion of the dollar volume, utilizes technical films along with manuals to cover as thoroughly as possible all types of technical training. The four experts gathered here have been carefully selected to give us the benefit of their wide experience in solving visual problems. Mr. Everett Baker of the Naval Ordnance Test Station at Pasadena and China Lake is going to discuss ways in which those of you who have in-plant film capabilities can develop your motion pictures more quickly through techniques that he has recently developed. Mr. Don Robert, the West Coast News Film Director of NBC News, is going to take Mr. Baker's thesis one step further and show how film and television have united to achieve extremely fast results on the video screens. Mr. Fierman, of KTTV, will then discuss an extremely interesting and vital aspect of our program, the use of video tape, which many of us feel offers a final solution to our need for fast, low cost visual communication. Finally, Mr. Bradley Kemp of General Films, Hollywood, will discuss the latest techniques for transferring video tape programs to the more popular and useful forms of 16 or 35mm motion pictures. A program has been developed to give you an insight into the new technical concepts that are now at your finger tips. Mr. Baker will discuss ways in which he can produce a motion picture film in days. Mr. Roberts will talk on ways he can produce films within hours, and Mr. Fierman and Mr. Kemp will discuss ways in which visual communications can be projected instantly.

And now, gentleman, in words of Miss Doolittle, "Show Me!"

DISCUSSION ON THE SHORT-CUT QUICKLOOK TECHNICAL FILM REPORT

by **Everett B. Baker**
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Motion pictures have become a popular means of describing equipment, and methods of producing them more rapidly are being developed. This paper compares the "Quicklook" procedure with the normal film preparation cycle.

One of the most famous Documentary Film makers, Robert Flaherty, is an exponent of what might be called, "the living in" process of research and planning for the making of a motion picture. It has been said that to become familiar with his subject, he has spent, on some occasions, prior to shooting, as much as a year just living in the environment, getting the feel, and gathering information. What a luxury it would be if occasionally in this hectic armament and space race, we could indulge ourselves with a little of this "living in" to give our pictures more dimension.

The present trend, on the contrary, seems to be toward more pictures on faster production schedules. Nowadays it is not uncommon, when explaining to a requestor that normal film production, depending on subject, length, complexity, animation, etc., may take anywhere from two to six months to have the requestor, after a moment's silence, say, "But I need the film for an important meeting next week. I'm leaving for Washington on Monday!" (Of course, in all fairness I should say that occasionally they give use a week or two longer.)

While it is true that every film-producing unit has had its quota of "crash" pictures, which incidentally have taught us a great deal about short-cut techiques, *what we are primarily interested in today* is the re-examination of production techniques to see whether we can find a set of Standard Operating Procedures for the fast picture that will make production possible without the usual wear, tear, and disruption that accompany the "crash" picture.

The need for standardization of this type of production has been increasing during the last few years with the growing demand for Quicklook pictures. There are about four primary needs served by this type of picture:

1. When something unusual has happened that people want to tell others about quickly.
2. When technical things or theories are changing so rapidly that only the Quicklook picture can keep up to date.
3. When someone really needs a technical film to do a job, but didn't plan far enough ahead.
4. When projects with little money are using the technique to get their story told cheaply.

Interesting and full of meaning is a consideration of various attitudes toward the type of picture we are discussing. Management seems to like them, provided that in the speed-up process, we do not pick up technical errors, or compromise policies.

Management's attitude is further portrayed by the following episode. The decision at the Naval Ordnance Test Station to embark upon the development of a standardized line of short-cut films is due in a large measure to the stand taken by the Head of our Propulsion Department who said, "I want to show my people in Washington on film, the things we are doing here. I don't care about smooth, professional pictures because it will take too long to get them. I am more interested in simple, timely, information-bearing films than I am in dissolves, pretty photography, and professional narrators. If it will make it easier to produce one picture every week or so, use the engineer as narrator and let him ad lib his own subject; he knows it better than anyone else."

Audience attitude to the speed line film is divided. Those for whom the films are intended, and who usally realize that it is either this or nothing, are very enthusiastic. Washington people who are dollar-conscious seem to appreciate the saving, but indiscriminate showing of some of them is ill-advised because they suffer by comparison when shown with pictures given normal production.

Of real importance to anyone considering a speed line operation is the attitude of the technicians on the production staff. They must be continually reminded that Quicklook films are not necessarily motion pictures in the finest sense of the word; they are rather a method of exploiting the film's capability for conveying timely information. Too many assignments of this sort tend to frustrate skilled motion picture technicians because they are often pulled up short of the goals they personally have set for themselves. Since short-cutting the techniques of a skilled technician may short-circuit the technician, you might lose him, either by separation or suicide! Management has a selling job to do in this respect.

But, enough of setting the stage! Let us get on with the show! The first two pages of the material being passed out to you represent a comparative study of standard procedures of normal production with the short-cut Quicklook production. The form shows at a glance the key areas for comparison. Note the two columns, the left one for normal and the right for short-cut production. The objectives are clearly stated. Let us study the form with special emphasis on the right hand column.

A COMPARATIVE STUDY OF MOTION PICTURE PRODUCTION TECHNIQUES

NORMAL PRODUCTION

Objective: A well made, effective picture that will complement its subject.

1. A LIESURELY PLANNING CONFERENCE with requestor to discuss picture need, audience, use, premise, schedule, costs, tentative target, and if possible set key personnel.

2. A MOTION PICTURE WRITER ASSIGNED to research project with help of technical advisor, and write a treatment and shooting scripts to meet motion picture standards, company policy, and technical line approvals.

3. PRODUCTION PREPLANNING as careful floor plan blocking, listing, scheduling and when necessary, preparation of story board layouts, titles, and art work.

4. SHOOTING AS AN ORDERLY APPROACH toward obtaining with the best equipment, personnel, and techniques available, the right scenes to best present in the most effective, artistic manner the material at hand.

5. LABORATORY PROCESSING on normal or priority basis is customary for original film work print and release prints.

6. EDITING FOLLOWS STUDIED, CREATIVE PROCESS of assembling work print scenes into rough continuity, exploiting all film shot according to best cinematic techniques, then tightening picture and narration together, and after approvals, finally cutting the original into A and B rolls for printing with smooth transitional effects.

7. NARRATION WRITING PERFORMED BY MOTION PICTURE WRITER, with occasional assistance from technical advisor or editor, consists of adapting previously prepared material to best fit picture as it emerges during editorial process.

8. RECORDING OF NARRATION using quality narrators, is most often done on magnetic film which is then carefully and precisely fitted to pic-

ture. A final balancing of narration, sound effects, and music is done during a later rerecording session.

9. RELEASE PRINTS are made by printing from A and B rolls of original and optical negative sound tracks previously transferred from magnetic sound masters. When the prints have been developed, they are ready for projection.

SHORT-CUT PRODUCTION

Objective: The use of film to get technical information to those having need to know in time for peak value.

1. PLUNGE RAPIDLY INTO THE PLANNING CONFERENCE with requestor to assess total situation and determine content of picture, order of sequences, availability of stock footage and hardware, assignment of all responsibilities, development of a shooting schedule with step deadlines necessary to hit a fixed target. Settle everything possible at first conference using the form which follows this table.

2. ENGINEER DESIGNATED AS WRITER and technical advisor with responsibility for development of narration, technical accuracy, and obtaining line approvals or picture content.

3. PRODUCTION PREPLANNING as quick follow-up on hardware, equipment, and personnel, whatever listing, blocking, and sketching time permits, fast layout of titles and art (mostly charts and graphs), and evaluation of stock footage to see what "filler" coverage is necessary.

4. SHOOTING AS A HURRIED PROCESS employing personnel in limited numbers, simple, straightforward, quick set-ups, portable equipment, and adequate lighting, with objective of getting information into intelligible images on film in best manner possible under circumstances.

5. LABORATORY PROCESSING is on urgent, rush-frantic basis with steps planned in advance on a laboratory coordinated plan.

6. MAKE BEST USE OF FOOTAGE SHOT in time alloted, even though editing follows short-cut techniques by either direct assembly of original, or master therefrom, into an "A" roll continuity for use in viewer during editing, projector during recording, or similar assembly of a work print for editing, recording, and as guide for cutting original into an "A" roll for printing. Time and taboo on special effects other than fades, makes A and B rolling unnecessary.

7. NARRATION WRITING PERFORMED BY ENGINEER with occasional assistance from motion picture writer or editor, consists of adapting technical data to best fit picture as it emerges during editorial process. . . . A specially prepared, footage-marked script form enables engineer to write narration to fit scenes without having footage present.

8. RECORDING OF NARRATION using project engineer or substitute, is done to a projected picture, either directly onto a magnastriped release print using a magnetic recording projector, or onto magnetic film running through a recorder in sync with picture for later transfer.

9. RELEASE PRINTS are made by printing from an "A" roll of original or master on single perf stock which is then magnastriped for a sound track. In urgent cases, release prints are printed on premagnastriped raw stock so that as soon as film has been processed, narration can be recorded directly or transferred over using a recorder or two synced magnetic projectors.

MATERIAL TO ACCOMPANY STANDARD REQUEST FORM

Getting off to a good, fast start is so important that I have developed this form to help crystalize production details at the first conference:

Part I is obviously general information that for the most part speaks for itself.

Part II shows the importance of speed in crystalizing the structure of the picture, and determining what exists in stock footage and what remains to be shot. With the speed line, one does not have the luxury of time to explore subtle story possibilities. If you want to move forward rapidly, the story structure must be settled quickly and arbitrarily.

Part III helps to place responsibilities and settle the production schedule on an alarm clock basis. By starting with the target delivery date and working backwards, one can see at a glance the speed with which each operation must proceed in order to ring the bell.

MATERIAL TO ACCOMPANY NARRATION SCRIPT FORM

This form, developed by a NOTS Engineer, Richard Carlisle, brings to the Standard Operating Procedures a way of writing and typing the narration so that it will fit the length of the visuals for which it is intended. The system works like this: When the footage has been edited into continuity order and the scenes tightened to decrease dead footage, the editor marks the footages and the scenes along the left-hand column. Each marked inch represents 5 feet of film. Footage is measured on a sync machine and the scene captions marked off in the approximate positions (see sample). Thus when the secretary types, beginning at the second verticle line, using either elite or pica type, she can space the material so that reading time approximately equals footage available. Three doublespaced lines per inch equal about 5 feet of film. If one line passes the elite or pica line, the next should be ended short of the line for the timing to come out right. With this form, the engineer can write the narration in his office away from viewers, or even while the edited original is at the lab for the making of magnastripe release prints.

To illustrate the Short-Cut Procedures we have been discussing, I have three short films from The Naval Ordnance Test Station. Unfortunately, my best examples are on Confidential subjects, so I could not bring them, but these will, I am sure, get the problems across. The first one, made for the Department Head previously quoted, illustrates many of the basic points. Note the simple silent titles, no music, the engineer narrating his own material and recorded on the magnastripe tracks after the prints were processed, and the simple lighting in fact absence of lighting (Super Anscochrome was used for the most part with just the available room light). A zoom lens was employed instead of a dolly to get some change of camera angle, and some of the uncertainty of the cameraman in framing is present. The part you will see was shot in one day by a lone cameraman. The section you will see ends very abruptly. This is no fault of the editor. It was too long for my time allotment, so I just cut it off in the middle.

The second selection is about a minute of poor man's animation made for a Quicklook picture on Rapec III. Instead of cells, which of course would have been too costly, the artist created in several days' time, a movable, colored cut-away. Unfortunately, I do not have the track on this one, but the general idea comes across silently.

The third film varies from the Short-Cut Standard in several respects: An optical track was used instead of magnetic because we were not sure a magnastripe projector would be available, a writer worked over the narration material supplied by the engineer, and the editor chose to A-and-B roll the original to get effects. However, it follows the Standard in other respects: It demonstrates the use of stock footage, it was a timely subject made for a specific target, and it demonstrates the compressed production time scale. The narration which was written the previous week, was polished and approved on Tuesday, recorded on Wednesday, the key firing occurred on Thursday at 2:00 P.M., the original processed that evening, the picture edited during Thursday night, and the A and B rolls Friday morning. The film went to the lab for printing at 2:00 P.M. on Friday. Two prints were ready by Friday evening, and one of them was flown to Washington Friday night to be shown at the Whitehouse Saturday morning.

In conclusion, the following axioms summarize the Quicklook picture:

1. Each person on the production should do the best he can within the imposed limitations.
2. During production, one must never lose sight of the primary objective of this type of picture.
3. Professional polish must bow to time scales.
4. Complex techniques must give way to straight-forward simplicity.

REQUEST FORM
FOR THE PRODUCTION OF
A
SHORT-CUT QUICKLOOK
TECHNICAL FILM REPORT

DATE ______________

I GENERAL INFORMATION

Requestor ______________ Code ________ Room ________ Phone ______
Project ______________ Picture title ______________
Classification ______________ Purpose ______________
Length ___ Film stock ______ Type track ________ Prints ________ Cost ________
Key person for requestor ______________ Room _____ Phone ______
Key person for production ______________ Room _____ Phone ______

II VISUAL SEQUENCES OF PICTURE IN CONTINUITY ORDER

A. Introduction to the problem
1 ______________
2 ______________
B. Preparation for key events
1 ______________
2 ______________
3 ______________
C. Key events
1 ______________
2 ______________
D. Evaluation, summary or significance
1 ______________
2 ______________
Use words "stock" or "shoot" after each sequence to show status.

III PRODUCTION SCHEDULE: Deadlines are indicated in right-hand column.

A. Production pre-planning
1 Hardware prep ______________ Start ______ Finish ______
2 Blocking and sketching ______________ Start ______ Finish ______
3 Titles and Art ______________ Start ______ Finish ______
B. Shooting of new footage
1 Sequences ______________ Start ______ Finish ______
2 Sequences ______________ Start ______ Finish ______
C. Film processing
1 Stock footage masters ______________ Start ______ Finish ______
2 New camera footage ______________ Start ______ Finish ______
3 Work print if used ______________ Start ______ Finish ______
D. Editing
1 New and stock ftg into picture ______________ Start ______ Finish ______
2 Prep of originals for printing ______________ Start ______ Finish ______
E. Narration writing
1 Rough draft ______________ Start ______ Finish ______
2 Final approved copy ______________ Start ______ Finish ______
F. Recording session ______________ Start ______ Finish ______
G. Final Lab work. Prt. Proc. Magst. Tran. ______ Start ______ Finish ______
H. Target delivery of first print(s) ______________ Start ______ Finish ______
I. Release prints in number ______________ Start ______ Finish ______

USE ONLY UNCLASSIFIED TERMINOLOGY ON THIS FORM

_______________ TITLE _______________ Date _______
Classification (when filled in) Page No. _______

U. S. NAVAL ORDNANCE TEST STATION
China Lake, California

Scene Description Opposite Footage Mark 5' film/col. inch.		Narration - Typed - Double Spaced (about 25 words per inch = 150wpm).	Elite	Pica

NARRATION SCRIPT FORM (for the "Short-Cut - Quicklook" Technical Film Report
11ND NOTS (T) 5728/1(4-61)

THE QUICKLOOK TELEVISION TECHNIQUE

by Don Roberts
Manager
News Operations
Pacific Division
NBC News

The pressures imposed by time and the problems involved in the programming of motion picture footage for television news programs are illustrated by five stories that were part of a typical 15-minute newscast.

I work for NBC News in Los Angeles and I am manager of News Operations of the Pacific Division. Our little shop, employing 21 persons, is responsible for news coverage for the NBC throughout the western states, including Hawaii and Alaska, and as you might imagine, we handle a lot of newsfilm from the Far East for our Network News Show. We are currently bringing film in from Laos and South Vietnam. One of our Los Angeles cameramen, Dexter Alley, is out there augmenting our staffmen and stringers in the area.

Of our 21 employees in Los Angeles, two are staff newsreel cameramen, two are film editors. The rest are editors, reporters, commentators (Roy Neal is one), and other office personnel. I should add that we frequently have a third and even fourth cameraman on duty as the workload dictates. Also, there is a cameraman's assistant and a sound man. Our film editors have an assistant to help with screening, splicing, and the like. Throughout the western states we have stringer cameramen to help in the coverage of breaking news stories. On the planned out-of-town stories we like to send our own crews and replace them temporarily in the Los Angeles area. So, in Los Angeles, we must cover stories for "Huntley-Brinkley," the "Today" show, our new Network News Syndication Service, Huntley's Sunday half-hour show, and numerous specials from "Project 20" white paper. Additionally, we produce for NBC's Los Angeles station two nightly quarter-hour news programs with Jack Lothom, and newscasts at 3:30 p.m. daily and at 6:45 p.m. Saturday and at 11:00 p.m. Sunday.

I have mentioned only those news periods that use news film. You can see that we are involved with covering stories daily for local output and very frequently for network use.

I understand that we are concerned today with the techniques employed to speed the film story through its various stages from the time the cameraman is assigned, until that story appears on the tube properly processed, edited, and scripted.

There is no better way to do that than to show you a few stories, all of the type that had to be covered "on the run" so to speak, and then comment on the work that went into them.

Before we do that I want to say that our film is processed at General Labs in Hollywood where an excellent job is done. Also of importance, the labs are just across the street from our newsroom. This saves us valuable minutes from lab to projector. Too, most of our people, no matter how big or small the job, are pressed into messenger service as a deadline approaches. This may seem like a small thing, but on a day that our film editor is just putting the finishing touches to a story and the clock is giving him a bad time, it is a pretty good thing to have a secretary, or even the boss, standing by at the lab to rush the test film from the developer to the editing room. I mention that because, in talking of attempting both speed and quality, there are many things done by many people — duties that never get into the manual.

It so happens that all of the five stories I am going to show you in a few moments were shot in the Los Angeles area by the same cameraman, a roughneck by the name of Gene Barnes. Three of the stories were breakers. We got the flash and the camera crew were sent flying. Once there, they had to ad lib. These stories were the Malibu fire, which runs for 2:15, the Chavez Ravine eviction episode which runs for 5:10, and the Beacon Cafe holdup, a story of cops, robbers, and hostages which runs for 5:05. The other two stories were planned coverages: Debbie Reynolds beseiged by newsmen at the time of the Debbie and Eddie marital mishmash, and a close-up study of an exceptionally brutal, yet pitiful murderer who was known as Killer Nash. He is seen as sheriff's deputies take him from the county jail in Los Angeles to a car for a ride to San Quentin. A few days later he was executed. This film piece runs for 1:40 and you will see that a newsreel cameraman is actually a cameraman-reporter as Barnes levels his heavy camera sound gear toward Nash and at the same time gets him to reply to newsmen's questions.

Each piece of film is significant here today for the reason that, in each case, "operation full speed ahead" was employed to get the story on the air as soon as possible. So, here they are in this order: Malibu Fire; Debbie Reynolds shortly after Eddie Fisher left her; the Arachega family evicted from Chavez Ravine to make way for Walter O'Malley's Ball Park; Killer Nash on his way to the gas chamber; and Cops, Robbers, and Hostages at the Beacon Cafe. (5:00 film 17:30)

In the case of the Malibu fire, we had hundreds of feet going into the lab every few hours over a period of several days. The cameramen would try to get word to us that the messenger was on his way to the lab. If the cameraman could not get through on the car phone, the messenger was instructed to stop at the first pay phone to call us. We would alert the lab, give them an ETA, and the messenger would call us as soon as he reached the lab. We would determine the probable time out of the developer. A messenger would be waiting for the processed film, rush it to the film editor, and writers would screen the entire batch of film. If time did not permit, the story would go right to the reader with references to the cameraman's hastily scribbled caption sheets.

Now, air time is approaching. The crew down in the studio is calling for the film. The director of the program just cannot understand why the news department does not set a deadline for film — like 3 p.m. for a 6:45 newscast. The film editor is finishing his job, the writer is struggling to make the copy synchronize with the film. Here is the fire chief's burning car, the movie star's destroyed home, the homeless family. Finally, the studio crew has the fire film scant minutes before air time, together with four or five film stories prepared earlier. The newscaster has his copy, timings are checked if time allows, and we are on the air!

Everything went fine, of course. The writer and editor were working with the negative and the director, or TD, did not reverse polarity so a few seconds of negative was seen on the screen before polarity was reversed. Actually, that very rarely happens as the written copy for each film story must designate negative or positive, silent or sound, and length.

Briefly, with the Chavez Ravine story, the staff had 2000 feet of film to work through to put together the guts of the story. The story began about 11 a.m. and went on until late afternoon. Because we were never sure how long it would drag on, or what turn it would take, we could not begin to put a responsible story together until it was over. The crew did not have much time, but they had a complete story on the 6:45 news.

Most of the film stock we use is Du Pont 936. We have a magnetic stripe put on the 400-, 600-, and 1200-foot rolls at Reeves Soundcraft in Hollywood. This speeds up the editing of sound stories; we feel the quality is better too.

TRANSFERRING VIDEO TAPE PROGRAMS TO 16 OR 35MM MOTION PICTURES

by Bradley Kemp
Manager, Video Recording Department
General Film Laboratories
Hollywood 28, California

I would first like to thank the Society of Technical Writers and Publishers for affording me the opportunity of appearing before you; the fine cooperation of the Ampex Corporation for supplying a video tape machine; also television station KTTV and Mr. Bob Fierman in assisting me in the more graphic presentation of video tape and subsequent film transfer, as used in the production of an instructional film training aid. Mr. Fierman in his talk discussed the technical points of time saving, and thereby cost saving of this type production.

Many of you may be witnessing for the first time, a close-up version of the modern electronic recording on magnetic tape, so, later, Mr. Fierman and I will answer any technical questions you may have.

It would be wonderful, for everyone other than Ampex Corporation, if you could purchase a video recording machine for $500.00 instead of $60,000.00. However, it is our intent to bring the information that was recorded on video tape, by virtue of transferring to standard 16mm sound film.

There is obviously no problem in projection of this type of material, and its portability and distribution assets are readily evaluated. Even today, we at General Film are printing 8mm magnetic stripe sound film, which is being used for instructions and training in sales.

We anticipate that within the year, you may store and disseminate information such as seen and produced on the video tape, and then reduced to 8mm sound film position. This should provide the ultimate in saving costs and in distribution problems, as 8mm is but half the cost of 16mm at the present time and may become lower in the near future.

We at General Film all recognize that yours is the vital and most difficult task of assembly and dissemination of highly technical information for the use of the technician and instructor-educator. The process of reducing or transcribing this information on film does not minimize your efforts, but rather augments and enhances them. It has been proved in the past that a person can learn some techniques quicker by a visual presentation. It is quite possible that in the near future technical papers will be augmented by instructional film. As a matter of fact, we at Video View have taken a video tape of classified material recorded at Redstone Arsenal, transferred it to film, and shipped the new instructions and procedures of complicated missile firing to many bases within 72 hours after the new technique was devised.

It would be presumptive of me to attempt to anticipate all your questions relative to the technical side of this new project, but I would like now to introduce a question-and-answer period wherein Mr. Fierman and I will answer your questions to the best of our ability.

PANEL 12 — THE FUNCTION OF DESIGN AND ILLUSTRATION IN TECHNICAL COMMUNICATION

ESTABLISHING THE LEVEL OF PRESENTATION IN TECHNICAL COMMUNICATION

by Ronald E. Ring
Manager, Presentations Department
The Martin Company
Orlando, Florida

In building an effective level of technical presentation, management must take the initiative in establishing and supporting a program, but should delegate responsibility to a single person who knows graphics and communications. The role of the designer is to understand management's problems, know the company's policies and markets, and help build up corporate or product image. A good designer may go beyond solving immediate design problems and assist in solution of larger company problems in such areas as organization, mechanical packaging, and plant layout.

It has been interesting to observe during the past two years an ever-increasing consciousness of the close ties which ought to exist between the designer and a thriving corporation. At the 1960 International Design Conference at Aspen, for instance, 400 designers, writers, and company executives spent five days discussing the theme of the meeting, "The Corporation and the Designer."

Once this awareness has developed within an individual company, several additional conditions are usually necessary to establish an effective level of presentation.

Before we discuss the roles played by top management and the designer, I would like to define two terms which I will be using throughout our discussion. First, "technical communication." I place great emphasis on the word "communication," in its broadest sense — all forms of communication, used to achieve a broad range of goals. "Technical" simply indicates to me a connection with the areas of science and technology and does not limit the form of communication to reports, handbooks, proposals, and technical articles.

Second, the term "designer," which I will use principally in the broad sense to include all those who contribute to the creation of effective communication programs, including the copywriter, the designer, and the printer.

What then are the steps which top management must take to establish an environment in which an effective level of design, or presentation, can be developed?

First, the design program must be initiated, coordinated, and supported by the chief executive. This is true because of:

1. The necessity for unity of purpose and action;
2. The large number of groups usually involved;
3. The need to accurately determine the broad function which the design is to serve;
4. The fact that design is only one part of a successful marketing or communication program (others usually include market research, an efficient distribution setup, an effective servicing program, and a quality product);

5. The need for the design level, to be fully effective, to apply to everything which contributes to the corporate image, including such things as building design and interior decoration;
6. The need to clamp down on high-level managers who assert their authority on design matters on purely aesthetic grounds.

Within the broad bounds of the design program, however, the decision-making responsibility should be delegated by the chief executive to a single individual on a high level of authority who knows graphics and communication. He may, and probably should, be backed up by a group of advisors, which may include various department managers or representatives, but he must be in a position to make the final decisions. I might point out that this does not necessarily imply a centralization of all communication support functions, since the groups responsible for this support may have divergent aims and audiences, and utilize different techniques. But one man must be in a position to set the tone, to establish the level, and to create the general standards to be followed.

Third, a specific and reasonable dollar budget must be established and not radically changed without good reason. Considerable debate has taken place on whether a company should increase or decrease its communication and sales promotion expenditures with changing market and economic conditions. Many persons responsible for establishing such budgets claim that sales will drop during a recession regardless of the amount spent for promotional purposes. Thus they reason that the budget should be cut. On the other hand, considerable evidence points to the fact that those companies which maintain or increase their expenditures during a recession regain previous sales levels much more rapidly once a recovery begins, and go on to higher sales levels than those companies which decrease expenditures.

Fourth, a thorough attempt must be made to measure the results on as scientific a basis as is possible.

Fifth, a decision must be made on whether a full-time staff will be employed, consultants used exclusively, or a combination of the two utilized. In such technical fields as electronics and missiles, we have found that exclusive use of consultants is unsatisfactory because they do not achieve the level of knowledge required in such areas as product design and capabilities, customer attitudes, and corporation policies and aims.

Next, top management must provide the freedom to fail occasionally without serious or long-lasting consequences if it is to expect the most creative and effective design programs to be generated.

Now, what must the designer do?

First, he must try to understand top management's over-all problems and responsibilities. For example, he must recognize that a reasonable budget must be established and that an earnest effort must be made to live within it. Insofar as possible, the designer should plan his communication program and measure its results in dollars and cents.

Second, the designer must not only understand top management's over-all problems but he should talk to the chief executive and other top-level managers in terms of their problems. This will help ease one of the designer's biggest problems, that of selling creative ideas in face-to-face dealings with top management.

Next, the designer must learn the facts about the company, its markets, products, and goals. On the other hand, the designer must have the courage to ignore the facts occasionally and rely instead on creative imagination. Perhaps the best current example is the Ford Motor Company, which made one of the most thorough market surveys on record before deciding to produce the Edsel. According to their findings, there was a significant demand for automobiles in the price class and with the features which Edsel provided. Despite this fact, the car was never a success and production ceased. On the other hand, it was anticipated by Ford that the Thunderbird would have a very limited market. Yet Thunderbird sales have grown so rapidly that it now outsells many of the so-called popular makes of automobiles.

Fourth, the designer should assist in identifying the company's specific markets and should tailor the company's design program to these markets.

Next, specific sales objectives should be established for each product (usually under an umbrella provided by the over-all corporate program).

Sixth, the designer should recommend a product or corporate image strategy. It is very important that a company identify which image it hopes to create. If a product strategy is chosen, the designer must avoid the danger of overplaying one product to the detriment of others.

Cooperation between the designer and writer is a must. We have tried an experiment which has proven extremely profitable. About a year and half ago we assigned one of our top designers to the copywriting group, under the direct supervision of the chief copywriter. This designer sits with the copywriters and is available continuously for design consultation. The result has been an usually effective integration of copy and graphics. We also make a regular practice of holding treatment conferences early in the development of a communication aid or program. At this meeting the copywriter and the designer, who have jointly researched the problem, present the approach which they feel to be most effective. The other members of the group, which include the art director, the chief copywriter, and myself, then join the copywriter and designer in further analyzing the requirement and the suggested approach. All differences of opinion between copywriter and designer are ironed out at this point.

Eighth, the designer should take advantage of the many mechanical advances currently being made in the graphic arts.

And last, the designer must always remember that the primary function of the designer is to communicate.

Now let's take a brief look at some of the creative elements which affect the establishment of an effective level of design.

1. The design program must be dynamic to meet rapidly changing needs. The present pace of technological change requires totally new design concepts.
2. Despite this rapid change, however, the basis of good design is still a thorough knowledge of people.
3. Design is not one detail, it is the whole.
4. The designer should constantly strive for simplicity in design and copy, consistency, integrity, and timeliness.
5. Leading designers set the trends; they do not follow them. Nevertheless it is interesting to note two recent design trends. The first is simple abstract design and straightforward, down-to-earth copy. The second trend is one toward the use of photo realism with a minimum amount of copy.

Next, the designer should always bear in mind that effective design means consideration of function first, content second, and form third.

A few general tips are also helpful in establishing an effective level of design.

First, some form of communication is usually better than none, even if it does not meet the graphic standards which have been established. This is especially true of internal communications, which in our industry includes communication with subcontractors. Therefore, when a high level of presentation has been achieved, communication should not be bottlenecked by the insistance that all communication aids be on the same level.

On the other hand, the satisfaction of top management does not necessarily mean that a design is effective. To combat this problem, we never show top management any design which we would not be willing to see in use.

Once established, an effective level of design will almost spontaneously create more good design, even on the part of those who previously seemed unable to produce it.

Because of this, at least one outstanding designer is a must. He is worth four or more less able designers, and the effect which he will have upon the creativeness of the others, and upon the over-all level of presentations, more than compensates for the salary which he may draw.

I would like to throw an additional challenge to the designer. Because of his comprehension of the creative process, the designer should be able not only to solve immediate design problems, but also to assist in the solution of the larger problems of a company requiring rapid adaption to change. Included are such areas as organization, mechanical packaging, and plant layout.

A good design program can also help a corporation to think more clearly about its goals both before and after the program is consummated.

To close, I would caution all designers to remember that good design, as such, is not a basic corporate objective. Rather, it is an important tool to assist in achieving several corporate objectives.

ILLUSTRATING FOR COMMUNICATION

by John Zane
Director of Advertising and
Public Relations
Cubic Corporation
San Diego, California

Illustration is the only universal medium of communication, cutting across language and time barriers with equal facility. The best technical communications are those where visual, verbal, and mathematical means operate as equal partners. However, visual means are generally secondary because (1) the best artists are visually oriented and, therefore, poor persuaders in publishing discussions which are carried on in words, and (2) the cost of printing complex illustrations is usually high. When the visual means is accorded parity and used in harmony with other means to express those aspects of communication to which it is best suited, technical communication will reach new levels of greatness and clarity.

From the time of the first cave painter at Altimira, 25,000 years ago, when a kibitzing hunter leaned over the artist's shoulder to say, "You got the horns all right, but I never saw a musk ox with feet like that . . ." everyone has felt himself to be a self-qualified expert on art and illustration. There is little that is new to disclose about ways to conceive and ways to execute illustrations. There is, however, a great deal to be said about ways to regard illustration and ways to use it.

Illustration, like other forms of language, is a process of abstracting in which certain symbols, by common agreement, have specific meanings. Illustration is the only universal medium of communication. It cuts across national and linguistic barriers as readily as time barriers. It antedates written language by many thousands of years. Its message is immediately clear to the observer. A modern American can read with equal ease the message of Norman Rockwell, an Australian bushman, a Renaissance Italian, a 7,000-year-old Egyptian, and a 25,000-year-old cave man.

Illustration, when used naturally and unselfconsciously, is as much a communication tool as language. This is especially true in technical fields. A ready example of this natural function is an engineer describing a new device or idea to a colleague. Scarcely one full sentence is voiced before he will reach for pencil and paper saying, "Now, here's the way it works . . ." He then sketches out an illustration of the subject. Or he may scribble out an equation. The point is that he selects a medium of expression which is best suited to describing his thought at any given moment in the communication chain he is linking together for his audience. But this all changes when the technical man starts his formal report. He no longer slips naturally and easily from words to pictures to mathematics. For some strange reason, the formal report becomes a verbal communication. A dogged attempt is made to express the entire idea chain in words. Then a few decorative illustrations and equations are strung about much like tinsel on a Christmas tree. And the tinsel is *on*, not of, the tree; it is an addition rather than a part.

When illustration is used as window dressing it is being used improperly to poorly perform another function. The other function is that of imparting mood and order to communication. This function is an expression of design.

In broad terms, communication is a process whereby information is transferred, through a medium, from inside one head to inside another. Technical communication is this same process when applied to information of a technical nature.

Normally, three types of tools are used in the transfer of technical information, i.e., verbal, visual, and mathematical. An optimum communication level is attained when the most suitable tool is used to fashion each of the several links which, when strung together, will comprise the message chain. This optimum level is seldom achieved because most persons feel that words are the proper means of expressing an idea formally.

Of these three means or media, the visual medium may be artificially dissected into two parts. The two parts are design and illustration.

Design tends to be an intuitive and symbolic process. In general, design imparts the emotional level of the message; it is a direct visual cue which immediately flashes to the observer the psychological impact of the material he is exposed to. Design also functions to direct the eye in its course through the message. In doing all this, design uses all the classical means (size, color, texture, direction, repetition, balance, tone, etc.) and, at the same time, leans rather heavily on an older form which has been given new power in the last few decades, i.e., symbolism. A pitfall of this latter device is the careless designer's liability to the use of too highly personalized symbols which communicate little or nothing to the observer.

Illustration tends to be a cerebral process of which the end product is a literal description. Usually, illustration describes objects, processes, thoughts, or concepts. A simple, classic example of the value of illustration, in contrast to words, is that of describing a spiral staircase to someone who has never seen one.

In producing his message, an illustrator is not bound to one medium or technique. He may "draw" his picture in a photographic manner or he may use an actual photograph. Or, he may devise a pictograph . . . or a cartoon . . . or a cutaway . . . or an exploded view. To the extent that his abilities will permit, he may use visual analogy to illustrate the unseeable, for example, in describing doppler effect. He must be highly imaginative in applying to the unknown, information derived from the known as in depicting the appearance of the moon from a station point 50 miles above its surface.

As in fine art, the greatness of technical art lies in the perfection of the blend of the preceding elements. In a masterpiece, the two are inseparable.

The best technical communication results when an equal partnership is established between the visual, verbal, and mathematical means. In general, however, the visual aspects of communication are relegated to a secondary level of importance. There are two main reasons for this situation. First: There are few to plead the cause of illustration and design. The best illustrators and designers are visually oriented, that is, they are most articulate graphically. Since publishing discussions, like other discussions, are carried on at a verbal level, the artist is largely a poor salesman for his own best product. Second: The cost of printing any but the simplest line illustrations is considered by many technical publishers to be too high. The high cost factor would make sense as a limiting condition if the point of publishing were to save money. But inasmuch as the purpose of publishing is usually conceded to be the transfer of information, it is a poor economy that jeopardizes the effort's very reason for being. The peculiar quality of such saving becomes even more apparent when one considers that the published document is quite frequently the *only* end product of a very expensive research effort. To save a few dollars in the final assembly of the researched information is as ill-advised as if Ford were to cut the cost on its Continental by giving the buyer a crate of beautifully tooled but unassembled parts.

Illustration should be used explicitly, directly, and succinctly to describe such objects, phenomena, or theories as are suited to expression in this medium. The same criterion of selection should apply to the choice between words or mathematics as media of communication. Once a portion of the message has once been expressed in its most appropriate medium, it should not be re-expressed in another. The illustrator-designer should be brought into publishing discussions as early as (and on an equal footing with) the writer-editor. When the visual means is accorded proper parity and when it is used in harmony with the other links in the message chain, technical communications will reach undreamed-of levels of greatness and clarity.

DESIGN AND TECHNICAL INFORMATION

by Stanley B. Hodge
Chief of Art Direction
Convair (Astronautics) Division
General Dynamics Corporation

The graphic designer, to be used effectively in industry, must have a voice in early planning. He must understand the material to be presented and have the authority and responsibility for the manner of its presentation. The designer's main responsibility is to communicate. His ability to do so is proportional to his knowledge of the forms and principles of art, his talent in creating art which will evoke response, and his understanding of the mechanical requirements of communications.

What and how technical information is to be communicated is too often the responsibility of the wrong man at the wrong level of authority. And too often the artist is the last man in the production sequence. He is expected to be the "wrist" to execute some pre-conceived visual clinker in an attempt to "dress up" the presentation. Under such conditions, the wrong kind of artist with an improper level of authority, if any, usually is chosen.

All of you know what technical information is. I am going to assume that some of you do not know what a graphic designer is, nor what he can do, nor how to take advantage of his particular abilities. At the International Design Conference at Aspen in 1959, William Golden, then the Creative Director for CBS television, described the graphic designer as follows:

> "The obvious function of a designer is to design. His principal talent is to make simple order out of many elements. The very act of designing exposes elements that are inconsistent and must obviously be rejected. When he is in control of these elements, he can usually produce an acceptable design. When someone else controls them, the best he can produce is a counterfeit."

I personally suscribe to this definition and submit that the key word is "control."

The graphic designer, if he is to be used effectively in industry, must have a voice in the preplanning at the earliest possible moment. To be effective, he must: (1) understand the material which is to be presented, and (2) have the authority as well as the responsibility for the manner in which the material is presented. If he does not understand and doesn't have authority, he very well may be only a window dresser for someone else.

If he does have authority, responsibility, and understanding, how does he go about the business of conveying technical information more effectively? The designer to some degree is an artist, and contrary to most people's assumptions, there is a structure to art which is demonstrable, self-evident, and to some degree measurable. A designer understands this structure; in fact, it demands most of his attention.

Let me attempt to describe art structure. [1] First of all, I will not attempt to define "art" — it is essentially undefinable, but it is clearly something that is man-made. When someone remarks, while looking at a picture on the wall, "What a beautiful sunset," he is guilty of gross misunderstanding, for what he is really looking at is a piece of canvas or paper which has had paint applied to it; it is man-made. Sunsets are a natural phenomenon and therefore outside the realm of art by the above definition. What the spectator is responding to when he observes the painted, man-made "sunset" is the memory of all the natural sunsets that he has experienced in reality, and the picture on the wall has simply pulled the trigger of his memory paraphernalia.

A "for-real" work of art is a man-made object which necessarily has a structure or form. This form can be described as having two basic ingredients. The first ingredient has two parts — it is self-evident and is perceived intellectually. The first part consists of the elements of form: color, line, dark and light, texture, and shape. The second part is also self-evident. It consists of the principles of form: transition, opposition, contrast, rhythm, harmony, symmetry, asymmetry, and many others. In other words, the work of art consists of the elements of form, and its success, as a work of art, can be demonstrated and evaluated according to the use of the principles, e.g., the contrast of small to large, black to white, or the rhythmic repetition of a pattern (texture).

The second basic ingredient is not self-evident and is perceived and evokes an emotional response. It is a personal response by the audience and is, therefore, nonmeasurable. For example, the work of art may radiate mood; it may have a message; it may be a societal commentary; or it may be a recording of an impression of an event, or a place, or a thing.

The designer's responsibility is not to make works of art — it is to communicate. However, his ability to communicate is directly proportional to his knowledge and use of the elements and principles of form. As he designs, the designer arranges and sorts things out — consciously and intellectually. If he is a good designer, and if he has had a chance to comprehend the technical information, he cannot but put some of his personal responses to the subject matter into his work, i.e., his nonmeasurable, emotional reaction to the subject matter.

The act of designing requires that the designer pay attention to two other basic considerations — mechanical requirements and psychological requirements — considerations with which you are all more familiar. The mechanical considerations are such things as money, time, paper, ink, paint, people, typography, printing presses, etc. The psychological considerations are the fundamental things which make up the personality of the designer — his Gestalten. These things are his education, his ego, his experiences, the effects upon his personality of his total environment. The designer's accomplishments are successful to the degree that he satisfies all of these requirements: the formal, the mechanical, and the psychological.[2]

At Convair-Astronautics, technical information is basically of two kinds: that which is required to support a contract (reports, tech manuals, and handbooks) and information which is not contractually required (reports, slide presentations, charts, brochures, papers, etc.). Our Product Support Department is responsible for the former, and the Art Section of the Communication Department is responsible for the latter.

The Communication Department is the responsibility of the Manager of Communication who is a member of the division manager's staff. As such, he participates in policy-making, and he has the responsibility for the division's noncontractual human communication efforts, and authority which is commensurate with the responsibility.

In order to accomplish the task of disseminating all of the division's noncontractual information, the task is relegated to six section heads who are responsible for community relations, graphic reproduction, editorial, still photography, motion pictures and television, and art.

The audiences which the Communication Department attempts to persuade, influence, or inform are the military, the industrial, the community, and company personnel. The art section, as a part of this communication team, is mostly concerned with the production of books and 35-mm slide presentations.

Most designers and/or artists in industry illogically report to engineers, writers, controllers,

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[1] Gardner, Helen, *Art Through the Ages*, 4th ed., rev., New York, Harcourt, Brace, 1959.

[2] Rand, Paul, *Thoughts on Design*, New York, Wittenborn, 1951.

etc., thereby forfeiting the control necessary to functional, communicative, high-level design. A slide presentation produced by such an art department will inevitably be laden with voluminous, grim, statistical, or technical data, and probably ornamented with arty, meaningless, distracting decoration. In short, the artist does not have the prerogative to rearrange, reject, or make simple order out of many elements.

Astronautics' designers have the authority and the responsibility to make the slide presentations communicative. Their most successful efforts result from the application of the design procedures described in this paper. The better slide presentations, in addition, subscribe to the Communication Department philosophy that (1) the speaker should not be allowed to merely throw his notes on the screen and proceed to read therefrom, and (2) each slide should convey minimal amounts of information. It is further believed that "the speaker is the thing" — the visual material is something to reinforce his salient points.

In summary, effective graphic communication of technical information is dependent upon designers who know art structure, mechanical processes, and are intelligent and talented. A stat clerk, your secretary, your wife, a technical illustrator (whose prominence, if any, is the result of longevity) cannot get the job done.