MONOGRAPH SERIES
OF THE INTERNATIONAL COUNCIL
FOR COMPUTER COMMUNICATIONS

VOLUME 1

the office of the future

UHLIG
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NORTH-HOLLAND

the office of the future

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COMMUNICATION and COMPUTERS

with a Preface by
Dr. Carl HAMMER

1979

NORTH-HOLLAND PUBLISHING COMPANY – AMSTERDAM • NEW YORK • OXFORD

ISBN: 0 444 85336 7

Published by:
NORTH-HOLLAND PUBLISHING COMPANY—AMSTERDAM • NEW YORK • OXFORD

Sole distributors for the U.S.A. and Canada
ELSEVIER NORTH-HOLLAND, INC.
52 Vanderbilt Avenue
New York, N.Y. 10017

Library of Congress Cataloging in Publication Data

Uhlig, Ronald P 1940-
The office of the future.

(ICCC monograph series ; v. 1)
Bibliography: p.
1. Office practice--Automation. 2. Electronic office machines. 3. Communication in management.
I. Farber, David J., 1934- joint author.
II. Bair, James H., 1943- joint author.
III. Title. IV. Series: International Council for Computer Communications. ICCC monograph series ; v. 1.
HF5548.2.U44 651'.4'02854 79-21001
ISBN 0-444-85336-7

PRINTED IN THE NETHERLANDS

INTRODUCTION

One of the principal goals of the International Council for Computer Communications is the dissemination of information covering all aspects of this highly dynamic field. Thus far this dissemination activity has been primarily the international conferences and proceedings (ICCC 1972, 74, 76 and 78). Other publication activities have included a special publication after the 1974 conference entitled "Views of ICCC 1974" and selection of COMPUTER NETWORKS as the official journal of the ICCC.

With this publication we in the ICCC are extremely pleased to establish another important publication activity, the Monograph Series of the International Council for Computer Communications. In the future, we plan to publish other monographs describing specific computer-communications systems as well as general topics such as the ones covered herein.

August, 1979

Philip H. Enslow, Jr.
Vice President, Publications
International Council for
Computer Communications

ACKNOWLEDGEMENTS

The authors would like to acknowledge the strong support of the ICCC Executive Council and particularly Peter Jackson, without whose support we would not be publishing this book. We would also like to collectively thank John C. Gilbert of the US Army DARCOM for his enthusiastic support of our efforts.

Each author also wishes to acknowledge the contributions of others. Also they wish to acknowledge the patience that each other has shown to the problem of generating a book when the authors are far apart geographically. Even the technology that we have described in this book and have used in its writing, has not completely removed the usual stresses and challenges.

Ron Uhlig and Dave Farber wish to thank their wives Beverly Uhlig and GG Farber for many hours of editing and head beating over the manuscripts and for the patience shown to having their husbands sitting at a console, at home, for hours at a time.

Dave Farber wishes to mention that much of the material has evolved from discussions and joint efforts with many people. Special acknowledgments should be given to Paul Baran of Cabledata, Steve Caine and Kent Gordon of Caine, Farber and Gordon Inc., Carver Meade of Caltech, Marco Negrete of Hewlett-Packard, Bob Stevens of IBM General Systems and Les Vadez of Intel Corp. He also thanks the National Science Foundation, the General Systems Division of IBM and the US Army DARCOM for the support that has supported many of the efforts that have underlain the ideas he has presented.

Jim Bair wishes to thank Richard C. Harkness of SBS for review of structure and ideas; Lou Fried of SRI for review and comments; Joe Hootman of SRI for his never ending support; National Archives and Records Service (USA GSA) for sponsoring related work; Mary Weiner, for editorial help; and Reddy Divily of SRI for help editing text. Of course the people of the Augmentation Research Center deserve thanks for allowing the space to learn, think, and study in a very stimulating environment. In general, many thanks are needed to the users of office automation systems who patiently persevered through questionnaires, tests, and interviews over the years.

PREFACE

by Carl Hammer

The all-pervasive nature of electronic systems was firmly established a decade ago. More recently, the advent of microelectronics has brought us personal ownership of immense computing power. What will the 'eighties have in store for us?

A simplistic model of the impact made by science and technology does not-perhaps cannot--exist to answer such a formidable question. A century of successive waves of engineering advances have altered both our personal lifestyle and our societal institutions. Invention and innovation have come upon us relentlessly, reflecting almost totally man's efforts to build muscleamplifying machines. Thus, we still travel much like our ancestors did--only faster; we alter the ecology of our planet, but more powerfully and irrevocably; even our weapons of war provide us simply with more horsepower--alas, an archaic term as horses have become almost extinct!

The mind-amplifying power of electronic systems applies to a different domain and it is significantly larger by several orders of magnitude. Scientific and engineering calculations considered "impossible" less than half a century ago are now commonplace (1); the calculation of PI to hundred thousand decimals is more a feat of machine resource management and organization than computation (2). Data processing as it was known to clerical labor forces and accountants during the early part of this century has been taken over on a scale that would have appeared inconceivable a generation ago; the routine issuance of thirty-seven million monthly checks by the Social Security Administration (3) was surely not in the minds of the late President Franklin D. Roosevelt and his advisor, Harry L. Hopkins, as they forged the 1935 Social Security Act. The efficient maintenance of large data bases with a quarter billion records (4) has become routine in government and industry; moreover, current systems allow for real time remote access from thousands (5) of terminals. The number of computer-readable data bases with public access has passed the two-hundred mark (6); the number of terminals in use (7) is estimated to be in the millions and growing!

One key to this evolution is, of course, digital computer communication. Without the existence of an efficient, nationwide communication network these advances could not have been achieved in the thirty year span since electronic systems were invented. In fact, many nations are finding out that their plans to "computerize" are met with frustrations as they must first learn to communicate. On the other hand, countries with reliable communications are examining the question of data and information flows across national borders (8), reminiscent of past protective tariff barriers for "real" goods. As corporate and national wealth shifts to ownership of "virtual" assets, entirely new legal issues arise from the need to protect, regulate, perhaps even tax them.

The old world order is also changing in the office domain. Our clerical work force is still growing in numbers--and in skills. Telephones, typewriters, calculators, filing cabinets, copiers and all the other implements or status symbols of the past are being augmented by "intelligence" in the form of electronic mind amplifying power. Even the mails are impacted by the introduction of facsimile and digital point-to-point transmission systems. There is much talk about the inability of our postal systems to deliver in the manner to which we have become accustomed. But such argumentation is missing the point: New services and new tools inevitably replace the antique and the quaint. As personal writing instruments advanced from the goose quill to the steel pen, the fountain pen and the ball point, so the means and media of intraand inter-office communications will and must undergo changes brought about by enabling technologies.

It is doubtful that the concept of office work will change significantly in the foreseeable future. There will always be records, memoranda, files, and processes connecting them. As seen from a general systems viewpoint, these processes will likely grow in complexity, keeping the pace with societal developments. But the execution of such processes will undoubtedly change as new and more efficient technologies allow us to discard their geriatric ancestors. Thus, the focus of the 'eighties must be on the purpose of the office and on providing meaningful work for the clerical worker. Many experiments will be conducted--and many will fail--before the true social significance of such work can emerge and be thoroughly understood. The battle between centralization and

decentralization will be fought bitterly by their respective proponents; in the end it will be realized that there is room for both systems. The "office in the home" will be tried and found to be wanting; gregarious mankind cannot overnight be transformed into a decentralized hermitage.

What is important, is that we transfer the artificial, man-made burdens of clerical mass activities to electronic systems capable of assuming such tasks of rote and drudgery without complaints. And that we emplace decision making processes into all hierarchical levels of the "office machinery", ennobling and enriching the dull lives of uncomplaining (?) millions who comprise the vast bureaucracies of our organizational structures. Even as we tinker with smart terminals and impart to our systems concepts of artificial intelligence, however defined, we cannot ignore the fact that human intelligence is by far the superior, at least for the time being. Its powers must be tapped to give our managers the new tools they will sorely need to cope with a future which many can at best envision only dimly.

The authors of this book have examined these issues critically and analytically. Their thoughts should stimulate office workers and managers to participate vigorously in the design and development of the Office of the Future. Now it is up to the readers to accept these challenges and go to work.

Citations

(1) Edward Kasner and James Newman, Mathematics and the Imagination, Simon and Schuster, New York, 1940, pp. 77/78 assert that "Even today it would require 10 years of calculation to determine PI to 1000 places". That was 1940, four years before the ENIAC!

(2) Daniel Shanks and John W. Wrench, Jr., Calculation of PI to 100,000 Decimals, Mathematics of Computation (Formerly: MTAC), Volume 16 (1962), pp. 76-99. This little gem also records an "undetected machine error".

(3) Review of a New Data Management System for the Social Security Administration, National Academy of Sciences (1978). The "Gigantics" include such items as 437,000 active reels of magnetic tape (at 6250 bpi).

(4) *ibid.* A more "exact" number is 240 million records maintained in the system, for persons, living or deceased.

(5) Donald J. O'Rourke, Packet Switching Services for the Autodin Community, AFIPS Proceedings, Volume 47, 1978 National Computer Conference, pp. 735746. About 8000 terminals and 250 computers comprise this network, perhaps the grand-daddy of them all.

(6) Computer-Readable Bibliographic Data Bases: A Directory and Data Sourcebook, American Society for Information Sciences (ASIS), 1978. The best known are perhaps the New York Times Index and Chemical Abstracts, but this volume is a veritable gold mine of lesser known services.

(7) David H. Axner and Fonnie H. Reagan, Teleprinter Terminal Survey, Datamation, Vol. 24 (1978), No. 5, pp. 232-255. There are 154 products from 54 sources and current production is estimated at 700,000 units per year.

(8) George Kroloff and Scott Cohen, The New World Information Order, Report to the Committee on Foreign Relations, United States Senate, Washington, D.C. 20510, November 1977.

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PART I: USES OF COMPUTERS IN THE OFFICE OF THE FUTURE

I.1 - Introduction

The Personal Computer

The dream of some kind of device to extend the intellectual capability of human beings has been in existence from antiquity in virtually every culture and in every age. The role of the magi and their political power in the middle eastern culture of 5000 years ago is a reflection of ancient man's desire to extend his intellectual capability. The use of the "Deus ex machina" in the Greek theatre of 2500 years ago is a later reflection of these desires. Alchemists during what are called the "middle ages" of western culture sought to extend their mental abilities with "magic" potions, and similar, unfortunate attempts through the use of so-called "consciousness expanding" drugs have been seen in modern times.

The introduction of computing machines to society 30 years ago held great promise for some practical realization of

the dream. Unfortunately computers were very expensive, and the cost of this kind of application was far too high for any real possibility of using computers to extend the intellectual abilities of the individual, on a personal basis.

The majority of people who came in contact with computers before, during and following the Second World War perceived them as calculation devices. The enormous extension to the kinds of computation that could actually be done was exciting enough for most people.

In the early 1950's a few people began attempts to apply computing machines to other than arithmetic calculations. A separate discipline which could be termed "business data processing" emerged from these efforts, as things like payroll, invoicing, and accounting became "automated". Scientific computing and business computing remained largely separate disciplines. But, in either case, the computer assumed more the role of a tyrant than a friend. Schedules of large businesses had to be built around the times when the computer was available. Because of high costs, managerial pressure was exerted for efficient use of the expensive, scarce resource represented by the computer.

This kind of use is still predominant in most of the world of computing today. Although the cost per unit of computation has steadily decreased, many people have been content with this view of computers and computing. The dream of a friendly personal computer has remained largely the domain of the science fiction writer. However, many dedicated computer scientists clung to the belief that computers should be a friendly servant that could be viewed as an extension of an individual human being's brain power.

Fortunately, these individuals believed in this view so strongly that they set out to build hardware and software systems that would work this way. When this work began, hardware costs were so high that it appeared that no practical results could come out of this research. However, several factors have combined in the last few years to make these efforts not only practical, but also essential to society in the future.

One of these factors is that, in the area of computer hardware, the Second Computer Revolution has begun. Fig-

ure I.1 shows some of the trends. The cost of computer logic circuits is expected to drop by a factor of more than 20 during the next decade, assuming present trends continue. Computer memory is expected to drop by a factor of 170 during this same period. The underlying technology is such that these trends should continue for several decades. As a result, this formerly scarce, costly resource is now becoming inexpensive enough that the personal computer can become something more than a dream.

Communication technology costs are also expected to drop during the next decade, although only by a factor of 3. Nevertheless, the expected drop in communication costs is very important to the office of the future, as society becomes more and more "information intensive".

The Information Explosion and Office Productivity

Society is entering the "information age". A large number of papers has been published during the last few years showing how society is becoming "information intensive." One by-product of the information explosion is the increasing scarcity of generalists. Information is becoming more and more distributed, and more and more specialists in various kinds of information are appearing. The need to combine information from many different sources and locations will become more acute as the information explosion continues. Computer communication is one essential ingredient in accessing information. The communication link may stretch half-way around the world, but it is equally important that it may only stretch to computers in adjacent offices, with very high communication bandwidths available. Increasingly complex communication is needed, regardless of distance. The ability to get at widely distributed information will be economically feasible, and an important element of the office of the future.

As part of the information explosion, the world has been undergoing an unprecedented explosion in the amount of textual or narrative information. The amount of information in print is increasing at an exponential rate. This is easily verified by looking at the number of pages printed in pro-