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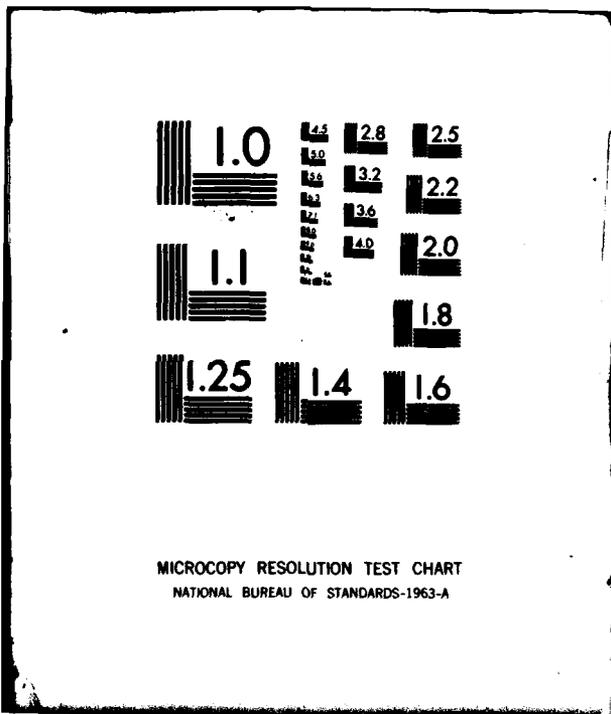
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HOWARD L. MORGAN

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The Future of the Office of the Future

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Abstract: If the much touted "office of the future" is finally here, what comes next? This paper describes some of the thoughts and observations of what the research community, and more advanced users are working on and looking forward to as office automation technology becomes widespread and mature.

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Introduction

Most of the attendees at this conference have already accepted the Office of the Future as an established fact. The techniques of word processing, electronic mail, information storage and retrieval discussed in a paper several years ago[1], are beginning to appear in off-the-shelf products from major and minor vendors. For those of us involved in long term research into how information systems can assist individuals and organizations in making decisions and processing information, the question becomes one of "What comes after the office of the future?" In this paper we shall attempt to provide brief descriptions of some areas of current research and development, and to suggest some further out possibilities to help answer that question.

Major Research Areas

At the present time, the major research areas affecting office automation are:

1. User interface design,

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2. Integration of functionality,
3. Distribution of intelligence,
4. Telecommunications,
5. Organizational and social impacts, and
6. Managing knowledge.

This admittedly subjective list encompasses those problems whose solution could dramatically change the way in which we view office systems. I shall discuss each in turn, and then hypothesize a scenario for the future office in which all the above problems have been solved.

User interface design

Present day information and word processing systems do a poor job of dealing with the user. With rare exceptions, systems are rude, intolerant, unsympathetic to user needs, and unable to interact with the user except in the most limiting of ways, i.e., through written or displayed text, and keyboard entry.

Some of the more successful research systems for office automation and decision support (in terms of user acceptance) have been built as graphics systems first. These systems realize that people are used to a much richer environment than one size of type on paper, and attempt to support that environment. The Xerox ALTOS has led the way in this direction. Multiple fonts, varying sizes of characters, varying black on white instead of white on black, all make people more comfortable with systems.

Even more exciting is the ability to make use of more of a person's sensory abilities. The Spatial Data Management System of MIT[2] and CCA[3] permit more graphical input and output of information. In the latest MIT versions, continuous speech and recognition of physical positions of the user permit one to point at the display surface and request information, e.g. "Show me Tuesday's calendar there." Such use of multiple cues assists the machine in becoming more helpful to users.

The use of natural language interfaces, which can understand English (and not necessarily grammatically correct English, which few of us use) again aid in permitting users to instruct systems without the high training barriers which we often face in today's commercial systems. Many of these systems correct simple and obvious spelling mistakes, and ask for proper clarifying information when necessary. All of these features should be commonplace in the future office.

So far, however, the attention has been mainly focused on the narrow task at hand - getting information into, processed, and out of the system. What is necessary is far more research into having the systems become more friendly to the user. If one of the goals is to create office automation systems which behave as effectively as the best administrative assistants one could find, notions of having the interface understand the user's mood, health, and overall context of work become far more important. The area of man/machine relations must be addressed

in a significant way for us to achieve these goals. We shall provide some examples later of how this might work.

Integration of functionality

It is not enough to have a group of separated tools in the office. In order to really gain the benefits from office automation, these tools should be integrated into a system. Such integration permits data entered through interactive data entry programs to be incorporated in words being processed in a document. It allows that document to be electronically transmitted to multiple users at dispersed locations for comments, which are transmitted, filed, and processed electronically on the same system.

Through all this, the user should be able to enter commands in a consistent fashion to a single interface. Thus, if the backspace character is used to delete the previous character while entering a mail message, it should perform the same function in text editing, data entry, and every other interaction with the system. This contrasts with the system on which the present paper was entered, where the backspace key is used by one editor, the left arrow by a second, and the rubout key by a third - to perform the same function of deleting a character.

This integration can be partially achieved by more coherent operating system structures. The UNIX system has been used in this manner to build an elementary integrated system[4]. But true integration requires much more agreement on the proper representation of different kinds of data, and their linking. Numeric data has long been structured into fixed format records and files, and there are many general purpose programs which can operate in an integrated manner on files. The report generators and program generators are examples. There is as yet no such generally accepted structure for dealing with textual information, and not even the outlines of such structure for handling pictorial and voice information are yet well understood.

Thus, research on text management - permitting, for example, various ways of attaching annotations to portions of text (something people do with pencils on top of letters all the time), voice annotation of text (comments we make while reading documents), and picture annotations (often called doodling) is required.

Distribution of intelligence

Microprocessors and inexpensive memory provide the opportunity to place computational power and memory at many different points in office systems. The user's terminal, local file systems, communications controllers, regional file systems, massive central facilities are all potential locations for some of the intelligence in the office of the future.

There is no agreement as to where and how such intelligence should be distributed. The old rules were based on economies of scale and specialization which no longer hold true. Many organizations are already finding that managers are bringing in personal computers to aid their own data processing - often in order to feed corporate systems.

If communications costs dominate processing, it becomes somewhat advantageous to place more intelligence closer to the user. However, as the requirement for shared access to files grows, use of more centralized intelligence to hold the files is indicated. Research into how to best achieve such distributed processing is ongoing. In the database field, some of the basic technical problems of securely and reliably managing distributed data bases has been investigated.

Rather than dwell on this issue, an issue which has received less attention to date is what type of devices can be made more intelligent. Portia Isaacson, in a speech to the 1978 SIGMOD Conference, suggested that one place the adjective "intelligent" in front of any noun found in

our environment and speculate on what an embedded microprocessor could do. Thus, we should be considering what intelligent chairs, desks, lamps, tape dispensers, etc. could do in our offices.

The chair could, for example, determine who was sitting in it by the use of weight distribution patterns. Through detectors of the amount of fidgeting going on, it could determine some correlate of mental alertness, and caution the user against making crucial decisions when tired. Such discussions, which seem idle speculation today, may have serious uses in the office of the future.

Telecommunications

If the major activity of managers is communicating, as many studies has shown, it stands to reason that a major area of impact on the office of the future is that of telecommunications. The design of local networking facilities, which permit people in a concentrated physical area (a corridor of a building, or a department) to have high bandwidth interactions with a dispersed file controller on that floor, has proceeded apace. Xerox has announced their Ethernet system, Datapoint their ARC (with Lightlink), and various other local networking methods (Burroughs loops, Prime rings) have become available.

Much more has yet to be done on interconnecting many networks together. The problems of addressing, standardization of format, directory structures, and network control are still of concern to researchers. The interconnections must not only permit computers on one network to exchange messages with those on other networks, but also permit the transmission and translation of information in varying modes (text, voice, image). The use of satellites, fiber optics, and non-coherent light sources are all methods being investigated to provide the bandwidth needs for the future offices.

It is now clear that all digital systems offer many advantages over the analog systems currently in use for data transmission. They can accommodate any type of signal (voice, text, image), and have better error correcting and detection properties. Research on efficient digital voice and digital picture transmission is ongoing. Teleconferencing techniques are being refined so that one can maintain eye contact with speakers located at different places around the globe, as well as audio contact.

The load being placed on the worldwide telecommunications systems from a large growth in office automation will take years to be absorbed and met. It is important that the end user side of these technologies not be ignored in the research process.

Organizational and social impacts

The potential for a change in the way our society is organized, and for how businesses operate, is now higher than at any time since the early industrial revolution. Various authors have talked about knowledge revolutions, a Third Wave [Toffler] and other massive change occurring in the next 25 years. Yet we do not even know how to measure the benefits of office automation technology to businesses, let alone understand the costs to society.

The ability to separate persons, and have them work effectively together, as has been done with early networks such as the ARPANET, points out some of the possible pitfalls and benefits. Some of the interesting observations which have been made include the lessened effects of verbal skills as opposed to writing skills, the reduction of inhibition when one can prepare a reasoned written response to requests for comments, and the increased social interaction among people who communicate on task oriented matters via electronic methods.

Serious problems, as accompany all major change, have been observed in many companies putting in word processing centers. Much more research into effective methods for introducing the types of change which office automation can bring are necessary.

Some of the prospects for society could be quite beneficial. The use of electronic methods for instant voting and polling, the creation of individualized newspapers for people, electronic funds transfers, and the potential health uses all fall into this category. Far more methodological research to create the proper measurement tools should be performed.

A key problem occurs in the amount of depersonalization and alienation felt by persons working with and using the outputs of these systems. Even though the systems can be used to provide far more individually tailored outputs, (e.g., personalized letters referring to items of interest as determined by computer based profiles), the recipients have not felt "happy" about being treated personally by a machine. We must learn to deal with such phenomena in the future office.

Managing knowledge

The ability to capture the procedural and judgemental knowledge of people in an organization will be of prime importance to the future of the office of the future. Companies today pay over and over again to recapture information which is already know to the organization. For example, if all of the address and telephone number information which I have on my desk were instantly available to all the personnel in my department, many calls to information, look ups in large phone books, etc., could be avoided. In a previous paper, we [5] have discussed a concept of Corporate Memory. Combined with the techniques which can be learned from artificial intelligence, the office of the future must be able to manage the knowledge of the office.

Zisman[6] described a system for the computerization of office processes. This system, SCOOP, permitted one to describe a process which required data processing, tracking, and document generation. One example was the process of editing journal papers. Additional work in this area is going on at Xerox, IBM, and MIT. The notion of being able to describe this type of knowledge is a first step in the true automation of the office.

Scheduling people's time, dealing with simple preference decision making (e.g., making travel arrangements), and providing limited domain area expertise (e.g., a financial analysis system) have all had experimental artificial intelligence "expert" systems built and tested.

Conclusions

We have barely begun to scratch the surface in the use of truly high technology to assist people in offices. The potential for coming in in the morning (or staying home and turning on the terminal) and being told, "Some interesting things have happened during the night, and after careful analysis, here is what we need from you - Should we fire Bill Jones? and should we pick the XYZ or ABC project in order to spend the money we are gaining from the new tax laws?." The manager need merely(?) utilize his or her judgement on the hard questions, leaving the easy ones to the system.

Hopefully the research community will provide some of the answers to help us face the future with more confidence.

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