Computers in the Information Society

Nathan Weinberg

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Acknowledgments

Several years ago when I was thinking about the increasing role of personal computers in our lives and considering how I might write about it, my friend Ronald Schwartz, of the Sociology Department at Memorial University, St. John's, Newfoundland, made one of his summer visits to California. During his stay, we found we thought along similar lines about the ways computers were becoming a part of our world, and we decided to collaborate on a book. I started to work on the history of computers and Ron returned to Newfoundland and started on the subject of artificial intelligence. If we had known how arduous this type of book would be, we might never have attempted it. Over the next three years, we exchanged ideas and explored the rapidly changing role of computers. Ron prepared a draft of the chapter on artificial intelligence but decided not to continue with the book when he went on an extended sabbatical to Asia to pursue his research in Tibet. For his friendship, his comments on the early chapters, and the enthusiasm he brought to our work, I owe him a debt of gratitude.

The first chapters of the book were written on an Osborne 1 computer with 64K memory using WordStar software and the CPM operating system. Later chapters were prepared on a Macintosh computer with 128K memory (soon expanded to 512K). The final revision was completed on a Macintosh Plus with 1MB of memory. In many ways, my personal experience and occasional frustration with these machines has become a part of this book. I am sure many other computer users have shared similar experiences over the last decade.

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Woodland Hills, California

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Introduction

Prior to 1980, computers and information systems were powerful but unfamiliar parts of the technology of our society. With the personal computer revolution, they became familiar if not commonplace. Ready access to computers and information databases has completely altered our relationship to this technology and has laid the foundation for the information society.

Computers, either alone or linked in networks, are changing the way in which people learn, work, and communicate. In this book we examine the unfolding cultural and organizational impact of computers on our society. Through this analysis we will come to better understand the role of information technology in our everyday and professional lives and the increasing interdependence between human society and its computer creations.

Through computers and information networks, human knowledge is becoming available at all points in society—whether to the individual, the school, the corporation, or the state. Using this information we can monitor, simulate, and control the processes of the physical, economic, and social worlds. In many respects, the information society can reach the scientific goal of understanding and controlling our environment.

Developing on an infrastructure of computers integrated with communications networks, the information society is not fixed in its form or structure. In the first decades of computerization, mainframe computer centers and time-sharing networks were the institutional norms, and large-scale data processing applications were the usual computational tasks. Since 1980, the focus of computing has shifted to mini- and microcomputer installations, local networks, and personalized applications. The end user requires a flexible and friendly computing environment that links micro and mainframe computer resources in a seamless and transparent network. This is the new computer environment that manufacturers and designers are working to create.

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In society generally, computers and information systems are causing substantial changes. However, as in any social transformation, the use of computers is not proceeding at the same pace in all areas, nor are the benefits of information technology evenly distributed. Some institutions have moved rapidly ahead, others have lagged behind. Problems and obstacles lie in the path of change to the information society. The investment cost in computer hardware and software is one major obstacle. The retraining of workers in organizations and factories is another. Nevertheless, in the United States, Japan, and Europe the governments and major institutions have committed themselves to this change as a necessary element for maintaining their economic, political, and military positions in the next century.

The text begins with an introduction to the role of technology in social change and a consideration of the expectations for computers and communications in the information society. The second chapter takes up the history of computer technology and begins our discussion of the organizational framework surrounding the use of computers. The following chapters on the computer culture and the computer in organizations describe the cultural and institutional frameworks that have developed over the last four decades and explore the differences that exist in the mainframe and personal computer environments. This portion of the book presents a coherent view of the technical, cultural, and organizational changes that have come with the widespread use of information processing technologies.

The next four chapters move from the overall picture to the specific effects of computers in education, government, health care, and industry. New goals and ways of working with computers are emerging in each of these social arenas, and a new culture is being formed using computers for analysis and distribution of information and for monitoring and control of technical processes. In education, the computer is changing the learning environment in the home, the school, and the university. In government, the computer is essential for the collection of social data and for everyday government operations. At the same time, government data banks may pose a threat to our privacy and liberty. In medicine, computer analyses and monitoring are changing the nature of patient care and altering the operation of hospitals. In diagnosis and health care delivery, the computer is becoming the constant assistant of the health care specialist. In industry, the techniques of factory automation, computer machine programming, and robotics are transforming or superseding the techniques of traditional manufacturing. We will examine the Japanese model of production, management and labor problems, and other issues in factory automation.

The final portion of the book looks at the future of computers and society. The chapter on artificial intelligence examines human and machine intelligence and reviews the efforts to create intelligence in computers. In the last chapter, the themes of cultural and organizational change and the positive and negative aspects of computerization are summarized. Some computer enthusiasts expect that the information society will usher in a human utopia. However, other writers are skeptical about these utopian expectations and critical of the coming of the information society. Computers and information networks could easily be used to extend the state's control over the individual and the group. In the workplace, the computer can displace, monitor, or speed workers in their tasks. With artificial intelligence, computer decision making could displace human control. The potential autonomy of intelligent computers raises a new set of concerns.

In the last decade, the new information environment has developed as computers and microprocessors entered the social and institutional mainstreams. Although there is widespread awareness of the changes coming with computers, most analyses proceed piecemeal from one topic to the next. By analysing the changing contexts in which computers are used we are able to see how the values and goals of science and industry are transformed. This perspective provides a view of computers and information technology that is consistent with our understanding of the development of science and industry and that looks forward to the emerging information environment.

1 Technology, Computers, and Society

The rapid development of computer and microchip technology in the last forty years and particularly in the last decade has been revolutionary in ways we are only beginning to understand. The miniaturization of electronic circuitry has made possible computers with ever more power and memory at lower cost. With X-ray lithography and new microchip design architectures, miniaturization will continue to advance to at least the end of the century. Yet, even as we approach the limit of existing lithographic techniques used to draw the chip circuitry, experimental techniques, including optical and biological circuits, are being developed to allow higher circuit densities. We can reasonably expect computers to increase in processing power and memory in the foreseeable future.

Even without further miniaturization, the latest personal computers and workstations are more powerful than existing software applications can readily use. As processing power and memory increase, software and hardware will be tailored to more specific purposes. In a brief time, we have become accustomed to the presence of computers in our homes, schools, and offices. In one respect, this development represents the latest stage of the industrial revolution. In another regard, computers are part of an electronic revolution leading toward a new society—an information society dependent on computer processing and mass data storage. From both perspectives, computers and microprocessors have become the technology defining and delimiting many of the changes in our world.

The Industrial Society

The modern world that surrounds us is the outcome of four centuries of social and technological change. The industrial revolution began in societies that were predominantly rural and agrarian. Systems of manufacturing arose from innovations in commerce and production and gradually changed the agrarian world into the mechanized urban environment that we inhabit. The pace of commerce grew in the seventeenth and eighteenth centuries with major European ports handling imported raw materials from Asia and America and shipping out European commodities. This world system of raw-material import and finished-good export marked the demise of small-scale craft manufacture and local trade. In the nineteenth century, scientific discoveries and inventions led to dramatic improvements in technology and the scale of production.

The transition from the traditional agrarian society to the industrial society was not smooth. Political and social strife was commonplace, and many groups opposed the disruption of the agrarian and craft world. Only in the twentieth century have we come generally to accept social and economic change. Cultural values and beliefs that welcome new technologies have achieved widespread approval. Among these are

1. belief in the effectiveness of technology and science to resolve problems and bring about progress,
2. enthusiastic reception of new inventions in the home and workplace,
3. willingness to try new modes of working and organization in industry and in society generally, and
4. acceptance of new ways of thinking, learning, and communicating.

In the industrial society, the values of the new, the modern, and the efficient have gradually replaced older values. At times, the advent of a post-industrial society in which leisure and sports would take on a new importance has seemed imminent.

The fully developed industrial society of this century rests upon a complex technological infrastructure of information, procedure, and organization. This infrastructure is characterized by

1. large-scale organization for supply, production, and exchange of commodities,
2. application of technical/scientific rationality to all problems and processes,
3. institutional administrative centralization and record keeping, and

4. increasing specialization and interdependence in all spheres of activity (education, labor, manufacture, and service).

The advanced industrial system rests upon a global pattern of communication, finance, manufacture, and trade that links the most technologically developed societies with less developed societies. Few societies have been able to resist the attractions of technological advance.

The development and wide adoption of computers and microprocessors marks a new technological plateau and has led to a new set of expectations for the near future of industrial society.

1. Industrial work will be largely automated through the use of robots.
2. New industries and services based on computers and communication will flourish.
3. A new decentralized pattern of work at home on computers will emerge.
4. New forms of organization based on computers and communication will develop.

These expectations are not far removed from the vision of the post-industrial society. At the same time, computers accelerate the existing tendencies in the technological structure toward centralization and control, interdependence, specialization, and application of scientific/technical rationality.

In the recent past, industrial society has received wireless radio, airplanes, television, nuclear power, satellites, and many other inventions with great expectations of marvelous change. Although we may greet new inventions with enthusiasm, the widespread adoption of a new technology is a complex cultural and organizational task. In the long term, we can see considerable change in the technological structure of society from the accumulated impact of many inventions and scientific breakthroughs. Social and cultural changes are more difficult to assess. In the case of any particular new invention or breakthrough, the expectation of revolutionary change may prove to be exaggerated. We have only recently learned to study and assess the impact of new technologies as we deploy them. The damage from environmental pollution and technological disasters have forced us to evaluate the balance of positive and negative effects from technological change.

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