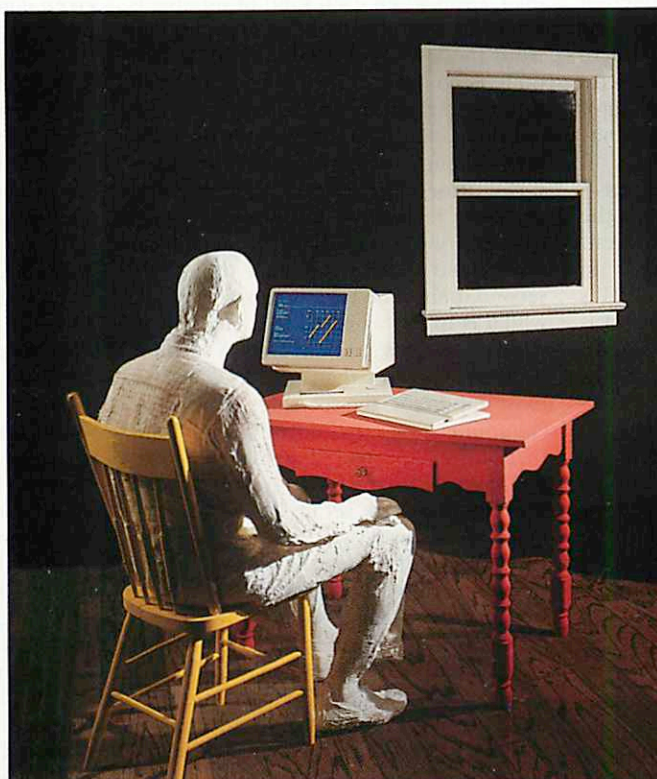# THE INFORMATION AGE

Brian Hayes

George Segal, Machine of the Year *(detail)*, 1983

Do It Yourself

They say we live in a service economy, that today the main business of business is not making things but tending to people's needs. We do for one another—you flip my hamburgers and I baby-sit your kids—and by some magic, wealth is created out of the transaction. Three-fourths of all jobs in the United States are service-sector jobs. And yet, to a remarkable degree we inhabit a self-service world.

Within living memory, people who were no more than respectably rich needed servants to help them dress in the morning and bathe in the evening. Now most families wash their own clothes, cook their own meals, clean their own house, drive their own car, mow their own lawn, shine their own shoes. The self-service elevator is all but universal. The telephone company has persuaded us to dial our own calls and now expects us to install our own telephones. In the past decade we have learned to pump our own gas. When we move the household, some of us rent a truck and haul our own furniture. We go to an automatic teller machine to do our own banking. There is even do-it-yourself surgery: after a minor operation not long ago, I was sent home with instructions on how to remove my own sutures.

The new emphasis on doing it yourself has brought with it tremendous social and technological change. Consider the supermarket, an institution founded on the idea of self-service shopping. The supermarket was made possible by changes in the packaging of goods, and it has given rise to further changes in both packaging and marketing, not to mention eating habits. Do-it-yourself laundry has a similar history. It was not enough to develop the automatic washing machine. A precondition for the success of that device was a detergent that would clean with a mere swishing in water rather than heavy-duty rubbing. And the advantages of the washing machine were not fully realized until the textiles industry developed fabrics that respond well to such treatment, thereby eliminating the need for the ironing board as well as the washboard.

The automobile provides another example. Do-it-yourself transportation is favored so strongly in most American cities that alternative means of getting around can barely survive. The result of the attachment to the automobile has been a thoroughgoing transformation of the landscape, the atmosphere, the world economy and the urban way of life. Nations are ready to go to war for the right to sit in a rush-hour traffic jam.

Not all the changes brought on by the do-it-yourself movement are entirely for the best. Supermarket packaging is overflowing our garbage dumps; phosphate-rich detergents are suffocating our lakes; the automobile is suffocating *us*. Nevertheless, the social effects of the do-it-yourself movement seem primarily beneficial. They reinforce the more democratic and egalitarian tendencies in American society. In my own life, at least, the new order is welcome. I believe self-reliance is a virtue. I am made uncomfortable by the close attention of personal servants. I will drive an extra mile to find a gas station with a self-service pump. I

certainly want no one else to draw my bath for me in the evening.

I would also like to believe that the self-service economy would be welcomed as an emancipation by those who toiled at pumping gas, shining shoes or pressing linen at steam-driven mangles. But of course the change in their lives has been a change for the better only if they have been put to better work; too often they have merely been put out of work.

The most dramatic social changes—but also the most ambiguous—are the ones that affect the roles of women. When the middle-class family gave up household servants in the 1930s, 1940s and 1950s, the work of those servants was taken on by the wife, who became cook, butler, valet, chauffeur. Indeed, wives are the heroes and pioneers of the do-it-yourself revolution. For some years—for a generation or two—a life of doing it yourself at home was the only choice available to many women. Lately that way of life has changed, as women have been welcomed back into the work force or have been compelled by economic necessity to rejoin it. One might therefore suppose that even men would now be learning to do for themselves. Perhaps some of us are.

Most of the developments mentioned above focus on the home and private life. There is a similar movement toward self-reliance under way in the workplace. In decades past the middle-class man of affairs—the one whose household included a cook, a gardener and a charwoman—was surrounded at the office by an equally elaborate support staff. In Dickens and Melville we read of copyists and clerks and office boys—all male. With the invention of the typewriter and carbon paper, copyists were eliminated, and subsequently women were admitted to office work as typists, stenographers and secretaries. Then came the photocopying machine and another shuffling of personnel; the typing pool was abolished. Now further changes are in progress or in prospect, driven this time by the availability of cheap computing power.

One case in which the issues are particularly clear is electronic mail (known to those who use it as e-mail). In my work I carry on a fair amount of correspondence, most of it on paper but a growing proportion flowing over the electronic networks. Most people who write to me on paper employ secretarial help to produce their letters. Electronic mail, in contrast, is strictly a do-it-yourself operation. As far as I know, I have never received an e-mail message that did not come directly from the hand of the sender. My own habits reflect the same pattern: when letters must be sent on paper, I often dictate

them, but e-mail messages I always write and dispatch on my own.

An important reason for the difference is the greater convenience of electronic mail, even when each kind of missive is prepared with the aid of a computer and word-processing software. With e-mail there is no need to feed letterhead stock through the printer and follow it with an envelope; once you have written the message, a single keystroke sends it on its way. Furthermore, standards of formality are more relaxed on the electronic network; no one bothers about typographical errors, and there is no such thing as a second draft. The tone is conversational, which is to be expected in a medium in which messages are delivered in seconds or minutes rather than in days. Perhaps most important, the sociology of network communications is quite different from that of the U.S. mail. The idea of e-mail was born on the ARPANET, the national computer network set up by the Department of Defense twenty years ago. The early users of that system belonged to the research community, and most of them were computer enthusiasts. They would no more ask a secretary to sit at their terminal and read their e-mail than a sports car enthusiast would hire a chauffeur to drive her Ferrari. (Of course some people in the academic world do not have a secretary—or a Ferrari.)

Another area in which the do-it-yourself movement has had a remarkable influence is engineering. A few years ago a mechanical engineer required the support of a cadre of subordinate designers, draftsmen and detailers, who spent most of their time preparing drawings. Today an engineer working alone can readily produce finished drawings and specifications entirely without (human) assistance. This feat is made practical by computer-aided design, or CAD, in which three-dimensional shapes are sketched and refined on a computer screen, while a corresponding data base records the evolving properties and relations among the represented objects. In some cases the output of the CAD program can directly control a computer-driven machine tool, so that the engineer not only designs the object but even manufactures it single-handedly.

In electronic engineering, computer assistance is all but mandatory. The designer of an integrated circuit works with a CAD program to define the structures that will be built up in various layers of metal, semiconductor and insulator on the surface of a silicon chip. Another program verifies that the design obeys all the geometric rules established for a given semiconductor technology, and still another program simulates the operation of the circuit. When the design is complete,

the data files can be transmitted (over the same networks that carry e-mail) to a "silicon foundry," where the chip is fabricated. Again a single individual has been given control of an entire manufacturing process.

What prompts these reflections on doing it yourself is a recent personal experience that has given me a sense of liberation similar to what I imagine an engineer might feel on turning an idea directly into hardware. Part of my work is to devise illustrations—drawings, diagrams, graphs and the like—for magazine publication. For many years I have done this by collaborating with an artist, who would attempt to draw what I dreamed up. The process would start with my sketch, however crude, which would serve as an aid in communicating with the artist. Then the artist would show me a more refined sketch, which I would revise; after two or three iterations of this process we would converge on a finished illustration. The multiple cycles of revision were needed not because the artist failed to follow my instructions but because I never seemed to know what I wanted to see until I had seen it.

Now I have discovered, to my surprise, that with the help of certain computer software I can prepare many routine illustrations on my own. The computer has not made an artist of me, but it offers so much assistance with the elementary, mechanical aspects of drawing—making round circles, ruling straight lines—that someone without much aptitude or training can fake it quite successfully. As a drawing tool the computer is not so much a better pencil as a better eraser. It allows you to see immediately where you have gone wrong and to revise endlessly without rubbing a hole through the paper. It also solves the "Plan Ahea" problem: if an illustration drawn on paper does not fit its allotted space, the artist may well have to start all over; working on a computer, however, one merely tugs at a corner of the drawing to rescale it.

Computer programs for drawing and illustration make up part of the technology called desktop publishing. Getting a bit of prose printed was once a collaborative effort of at least eight people. A writer wrote it; an editor edited it; a compositor set it in type; a proofreader checked the compositor's work; a designer laid out the pages; a printer or a paste-up artist put the type into the pages; a lithographer or a stereotyper created printing plates; a pressman (or a press crew) ran off the copies. Most of this work can now be done by one person, sitting at one machine. Writing, editing, setting type, proofreading, designing and putting type into pages all are tasks for the solitary desktop publisher; only platemaking and

printing still require investments of craft and capital that are beyond the means of the individual.

In music too, as in the graphic arts, there is the promise of a new autonomy. The computer will not turn you into a musician or a composer, but it will remove some of the emphasis on performance skills. With a computer program called a sequencer you can piece together a melodic invention note by note, as slowly as you please, and the machine will then play the composition at its proper tempo. You can keep trying different notes until you finally stumble on the right one. Moreover, you become conductor as well as composer, and you can hear your work in its fully orchestrated form without hiring Carnegie Hall. A one-man band indeed.

Even in areas as cool and forbidding as statistics and mathematics the computer has introduced a new spirit of self-sufficiency. There was a time when a biologist with experimental results to analyze might have asked the advice of a statistician and would surely have enlisted the help of a graduate student to perform the numerical work. Computer programs have now taken the drudgery out of the more routine mathematical tasks—fitting a curve to data, say, or estimating statistical significance. What is more remarkable is that there is mechanized help available even for higher mathematics: with a program for symbolic manipulation I can solve equations beyond my capacity with paper and pencil. I feel sheepish in saying it, but I can come up with answers to problems I do not understand.

What about do-it-yourself computing? A long-standing dream of computer science is to dispense with the profession of programming and enable those who use computers to create their own software. A lot of that is going on: much excellent software is being written by people whose training is not in computing. So far, however, people have been adapting to the needs of the machine, not the other way around. Physicists learn to speak FORTRAN; astronomers control their telescopes with programs they write in FORTH; businesspeople master the intricacies of linear programming and other algorithms for optimization. The software that will make computing easy for everyone does not yet exist, but it may not be an altogether vain notion.

I have said that I welcome the social effects of self-reliance in personal life, but what about the consequences of such changes in the workplace? The various trends described above would appear to be bad news for secretaries, draftsmen, illustrators and proofreaders, among others. The compositors who once operated stately Linotype machines have already been displaced. The jobs of programmers may one day be in jeopardy, and for that matter editors are not totally secure.

On the other hand, one ought to keep in mind that telling a machine what to do will always be more difficult than telling a person what to do. It seems unlikely, therefore, that captains of industry will ever give up their trains of aides and assistants. As a matter of fact, the social milieu of most large corporations seems set up to reward dependency and to discourage self-reliance. After all, it is a milieu dominated by people whose very function is not to do it themselves but to tell someone else to do it. The way to get ahead in that world is to manage people, not to operate machines. As long as the boss claims she cannot type, the secretary will not disappear; but with any luck, he might get to do more interesting work.

There are other reasons for having misgivings about the do-it-yourself movement. In the arts and the sciences the changes under discussion here amount to a triumph of amateurism. Computer-based tools may compensate to some extent for the amateur's lack of skill, but they cannot make up for a failure of taste or judgment. Professional artists and designers cringe at some of the products of desktop publishing, which tend to show the exuberant recklessness of a child's first adventure with a can of spray paint. Even when the worst offenses are avoided, it often seems that something is missing. A living and breathing artist will listen to your plans and then respond, "I have a better idea." Computer programs do not volunteer.

In the end the main effect of the computer on aesthetic sensibilities may be to increase our appreciation of those arts and crafts that continue to resist mechanization. I have learned to produce meticulous diagrams of carefully plotted geometry, but what I admire most is the sure brush stroke of the watercolorist, who works in a medium that supplies no erasers, in which it has to be done right the first time.

Finally, I must admit to a doubt about the healthfulness of all this autonomy and self-sufficiency. Doing it yourself offers important psychological rewards and gratifications, but as a way of life it can surely be taken too far. Ultimately we are left with a vision out of science fiction: the isolated mastermind, seated at a vast control panel full of dials and knobs, pushing a button to synthesize a string quartet or publish a book or start up an assembly line. It is a vision of power and control, but rather lacking in human warmth. ●

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