


# Technology Review

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

APRIL 1990

\$3.00



## SEEKING A RADICALLY NEW ELECTRONICS

*The quest to exploit  
"quantum effects" in structures  
that approach the size of  
large molecules.*

ALSO:

**KERALA, INDIA:  
ECONOMIC PROGRESS  
WITHOUT GROWTH**

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**HOW PATENTS COULD RUIN  
THE SOFTWARE INDUSTRY**

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**WHAT TO DO  
ABOUT SEWAGE**

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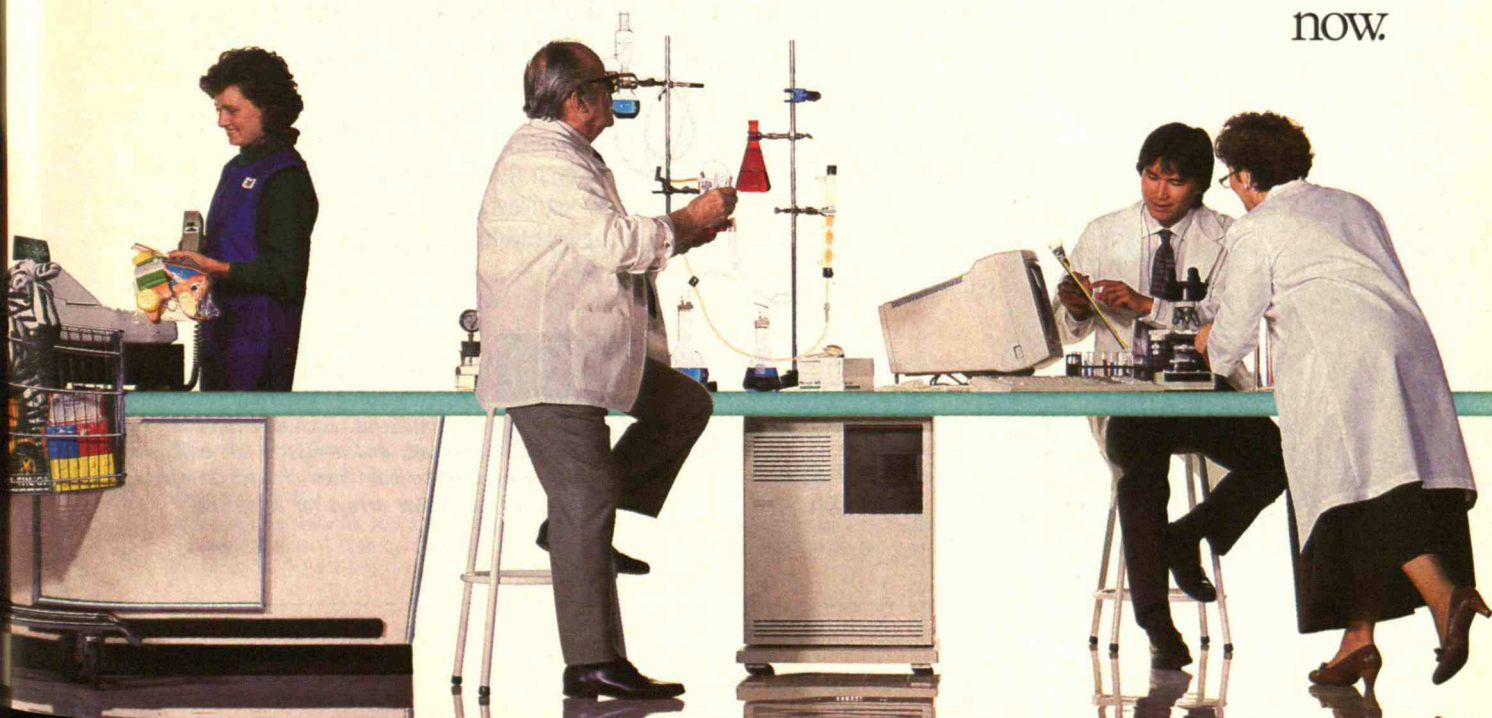
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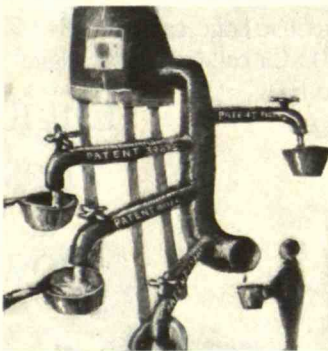


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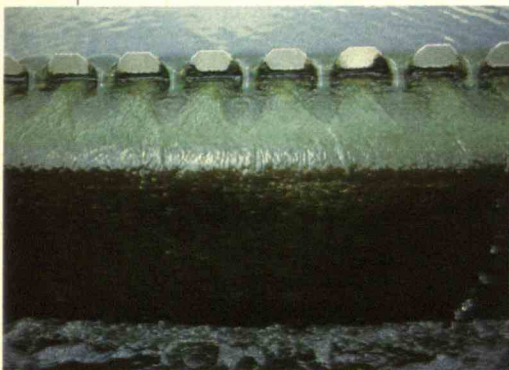
BY BRIAN KAHIN

The U.S. Patent and Trademark Office is awarding exclusive rights to thousands of programming processes ranging from machine instructions to features of the user interface. The independent software entrepreneur may all but disappear and the vitality of the industry is at stake—as is the future of computer-mediated expression.

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BY DONALD F. HARLEMAN

Congress has ordered coastal communities to adopt an expensive form of sewage treatment even though newer alternatives are more effective. The lesson: set federal cleanup standards and let each community choose the best technology to meet them.

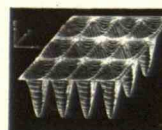


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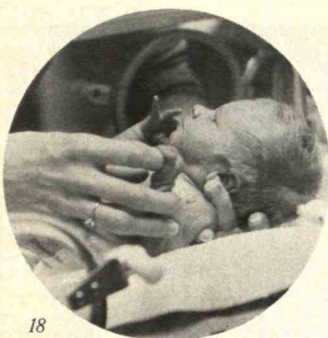
Illustration by  
Stephen Elston

Design by  
Kathleen Sayre



The cover is based on a computer print-out representing "quantum wells" in a semiconductor. Each well can hold a few electrons, and arrays of 200 million such wells per square centimeter have been created. Researchers hope someday to use similar arrays for computing.

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## Children and Investment

**P**OLAND'S dissatisfaction with its backward technology surely underlies its eagerness to adopt free markets—the coal used for heating in Warsaw fouls the air with soot as if it were Dickens' London. Poles acknowledge that the discipline of the market will bring unemployment and run up costs of food, housing, and other necessities as price controls are lifted and weak firms allowed to fail. But they hope the free market will encourage investment in new enterprises to make the economy grow. This approach is seen globally—in Eastern Europe, China, Latin America, Africa, and elsewhere—as the route to prosperity. During the 1980s the International Monetary Fund (IMF) and World Bank have imposed similar free-market “economic adjustment” programs on Third World debtors.

*The State of the World's Children 1990* by the United Nations Children's Fund (UNICEF) suggests a fundamentally different perspective on the world economy. During the 1980s, free-market programs and reduced government spending contributed to a direct and brutal disinvestment in the lives of children. As incomes fell 10 percent in most of Latin America and over 20 percent in sub-Saharan Africa, there was nothing to stand in the way of malnourishment for the poorest. Per capita health-care spending declined in three-quarters of the Latin American and African countries, while two-thirds of what we call “developing” nations reduced their budgets for education. Even in the United States, where the economy grew substantially, the proportion of children living below the poverty line increased 36 percent. In New York, the financial capital of the world, 40 percent of the children live in poverty.

Such disinvestment is all but irrever-

sible. As Richard Jolly, deputy executive director of UNICEF, told a congressional committee: “Investment in human capital in the form of nutrition, basic education, and health cannot be postponed: it either takes place at an appropriate age when the need is present—or it does not. For the young child, there is no second chance. The underemphasized tragedy of the disinvestment in human capital in the 1980s is that the results will be carried forward in stunted bodies and deficient educations well into the twenty-first century.”

Which should have the first call on social investment: the minds and bodies of children or new machinery? To ask the question is to answer it. A generation's impact on society far outlasts any physical capital. German industry was destroyed after World War II, but the nation was able to build on its long tradition of excellent education.

### Means Versus Ends

The free-market approach that seeks economic growth often forgets that this is not an end in itself but merely a means to the goal of alleviating poverty. While most economists are concerned with per capita income, inflation, and such data, UNICEF measures progress by directly counting the number of children out of each thousand who never reach their fifth birthday. This tells a great deal about factors such as the availability of food and clean water, the state of a country's health-care system, the overall safety of the environment, and mothers' health and knowledge about health. *The State of the World's Children* ranks nations from Afghanistan, where 30 percent of children never reach five years old, to Finland and Sweden, where only 0.7 percent are dead by that age.

By this ranking, free markets do not do very well, as Vicente Navarro of the Johns Hopkins School of Hygiene and Public Health has pointed out. Compare India and China, two large, ethnically diverse Asian nations, one with a

free market, the other a planned economy. China had a higher under-five mortality rate than India in 1945, according to earlier UNICEF reports. By 1960 the two countries had switched places, China's rate falling to 202 per thousand while India's was 282. Today, though their per capita incomes are nearly the same, China has an under-five mortality rate of 43, while India's is 149. China's adult literacy rate is 69 percent, while India's is 43 percent, and China's life expectancy is 70, while India's is 58. (“The Kerala Experiment,” page 42, describes what one relatively poor Indian state has been able to achieve through efforts to redistribute wealth rather than promote growth.)

The same sort of relationship holds in Latin America. The planned economy of Cuba has the lowest under-five mortality rate, 18 out of 1,000, as well as 96 percent adult literacy and an expected life span of 74 years. By contrast, Honduras and El Salvador have under-five mortality rates of 107 and 84. Large, industrialized economies have comparable rates—Brazil's is 85 and Mexico's 68. In Europe, under-five mortality rates in the Eastern bloc are slightly worse than those in the West. For example, West Germany's is only 10, while East Germany's is 12. However, the East German rate is slightly better than the U.S. rate of 13.

The socialist countries' lack of basic liberties such as freedom of speech and travel is indefensible, but UNICEF's figures suggest that they have done relatively well in defeating the worst human economic misery. This is not surprising: for all its clumsiness, central planning has aimed to do just that. Eastern Europe's technological backwardness demonstrates that the invisible hand of the market has an undeniable efficiency. But human progress ultimately requires conscious planning. The world is likely to need such planning as it faces issues ranging from children's health to the global environment. ■

JONATHAN SCHLEFER

# TechnologyReview

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# Letters



## THE PRODUCTIVITY RIDDLE

"Making Sense of the Productivity Debate: Reflections on the MIT Report" by Jonathan Schlefer (*TR August/September 1989*) is the best example of eloquent writing from an intelligent open mind I have ever seen.

I would like to add that one of the more curious things about the MIT commission is its members. That these people have been tremendously successful in their chosen fields is without question. On the other hand, if people are successful within a structure, they fit the requirements of that structure. And this means that any problem with the structure is also their own problem, which makes it hard for them to see what's really going on. But then again, the situation could have been worse—at least the commission was not made up of the heads of American industry.

JAMES P. GARIN  
Atlanta, Ga.

## DRAWING THE LINE IN HEALTH CARE

Here in a community of retirees, the no-win situation Arnold Relman presents in "Confronting the Crisis in Health Care" (*TR July 1989*) is particularly acute. Ironically, the longer our lives are extended by medical and surgical advances, the more health care and custodial care we need. Few of us move into our 70s without increasing dependence on the medical establishment.

A question then arises: In these days of parts replacement and other surgical techniques requiring a roomful of specialists, are we oldsters getting too large a share of the health-care resources, especially when society is paying the bill through insurance or

subsidy? Perhaps one solution would be to establish a health-care quota for each of us at—say—age 65. For example, we might each be assigned 2,000 health-care units to be applied over the rest of our lifetime for medical, surgical, and skilled nursing care. A simple checkup might cost 20 units; a major parts-replacement operation 1,000 units. When one's quota was used up, one could expect nothing beyond the simple homestyle care of past generations. Such a system surely would be less drastic than it sounds, because both patient and physician would probably develop a new conservatism as the end of the quota approached.

E. SCOTT PATTISON  
Dunedin, Fla.

The interview with Arnold Relman is disappointing. Not only does Dr. Relman dispute well-known facts and contradict himself, but he unreservedly advocates socialized medicine.

First, we know beyond doubt that technology makes every other area of our lives easier, richer, and more productive, so why should technology make medicine less efficient? Contrary to what Dr. Relman says, technology has not been the engine of cost escalation in medicine. Whether rich or poor, patients can and do make appropriate medical choices based on both medical knowledge and economic facts. Grants to consumers (or "welfare") are inflationary because they distort these facts. It is thanks to "first-dollar coverage" (very small deductibles and co-payments), as provided by Medicare and employee benefit plans, that the rate of increase of medical prices—those of the new technology, in particular—exceeds that of all other consumer prices. It will continue to do so for as long as such politically generated infusions of funds exist.

Second, the centralization Dr. Relman advocates inevitably means bureaucracy and waste, because it takes decision-making powers away from the persons who know the most relevant particulars. Even the best physician is

bound to make errors as a manager and planner of other physicians' work. Dr. Relman would have us believe that we could eliminate waste by decree—just wish it away—even as we further centralize and depersonalize medical care. This is absurd.

Third, standards are the hallmark of the bureaucratic way of doing things, and they inevitably stymie good medical care and slow down progress. Yet Dr. Relman—even as he decries the ignorance the medical textbooks contain—calls for more and tighter standards of care. It should be plain that such standards are nothing but imposed ignorance, unlike voluntary conventions of language or notation.

Dr. Relman repeatedly declares against market medicine, ignoring that only the market can establish a relevant price system. If we go his way (and we certainly are), we can expect only higher prices, less freedom, and worse medicine.

GEORGE YOSSIF  
Birmingham, Ala.

## DISSENT IN BRITAIN

Bennett Harrison's fine assessment of Britain's industrial problems (*"Fail Britannia?"* TR October 1989) neglected to mention the attitude of the country's factory and shop workers. Britain's decade-long rise of murderous soccer-game riots is occasionally reported in the U.S. media. But the escalation of civil disobedience, assaults, and murders in the streets and workplace generally is not, so many of us are unaware of how restive the working class has become.

There are large numbers of Irish Catholics in the workforce of Liverpool and other industrial centers. Many are outraged by the torture, killings, and miscarriages of justice suffered by Irish Catholics as Prime Minister Margaret Thatcher's forces fight "Irish Republican Army suspects." These workers cite, among other things, the Gibraltar killings, in which a death squad shot three such suspects in the back with 50 rounds of ammunition, and the "bloody



Sunday massacre," in which British troops fired into a civil rights procession, killing 13 unarmed civilians. Harrison's conclusion that our industrial prospects are similar to Britain's does not account for any of this.

ROBERT F. McALEVY III  
Hoboken, N.J.

## COMING TO TERMS WITH CHERNOBYL

"Chernobyl: What Really Happened" by William Sweet (TR July 1989) is revealing and disturbing. What's more, the problems of the troublesome Soviet RBMK reactors may hit closer to home than we expect, since a Soviet nuclear power plant is currently under construction in Cuba at Cienfuegos. As early as 1990, the people of Florida could have a nuclear plant of Soviet-Cuban design operating only a few hundred miles offshore. And four more nuclear plants are scheduled to be built in Cuba in the ensuing decade.

J. RICHARD SHANEBROOK  
Schenectady, N.Y.

*Technology Review* is to be congratulated on "Chernobyl: What Really Happened." In my opinion, the article makes it clear that we can deal with nuclear energy effectively if only we keep in mind the saying familiar to all MIT undergraduates: "Power is dangerous and must be handled prudently." The lessons the disaster drives home are the same ones our ancestors learned in the nineteenth century when railroad bridges regularly fell down and steamboats regularly exploded.

I also admired the article's stunning photographs from the Soviet government. But I can't say the same for the rest

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of the artwork—specifically, the diagrams. First of all, the drawing titled Fuel Channel (page 48) appears to show a fuel rod. And it does not show why the welds, which can barely be made out, are particularly weak or dangerous, as the author asserts. This drawing, besides being mislabeled, conveys no information. Furthermore, the sketch titled Chernobyl-Type Reactor seems to indicate that Soviet engineers have invented a new thermodynamic cycle, one running on hot water rather than steam. One might call the new device an internal evaporation engine.

Finally, the graph on page 49 is not clear. I would understand it better if Mr. Sweet had explained in the text how “neutron power” differs from power in general, which as an MIT freshman I was taught is the rate of doing work. Also, the label for the ordinate of the graph—%neutron power (in thousands)—appalls me. This locution was last heard on TV: a candidate was saying he supported his running mate “1,000 percent.” Politicians don’t know any better, which is why the president has a science advisor. But I expect more from a document edited at MIT.

SHEA LABONTE VALLEY  
 Concord, Mass.

*The editors respond:*

We welcome Ms. Valley’s congratulations and apologize for the difficulty she encountered with the illustrations. Yes, the drawing depicts a fuel rod, and yes, the sketch of a Chernobyl-type reactor is incorrect. In regard to the graph, this is an artist’s rendition of one of a number of calculations the Soviets have supplied in the wake of Chernobyl. We chose the neutron-power graph since it clearly illustrates the possibility that two explosions occurred. The Soviets labeled the ordinate “percent neutron power,” and we didn’t want to alter that.

### THE PERILS OF PRESTIGE

In “Why Scientific Education Is Liberal” (*TR* February/March 1990) Jonathan Schlefer presents some interesting ideas about the conservatism behind his