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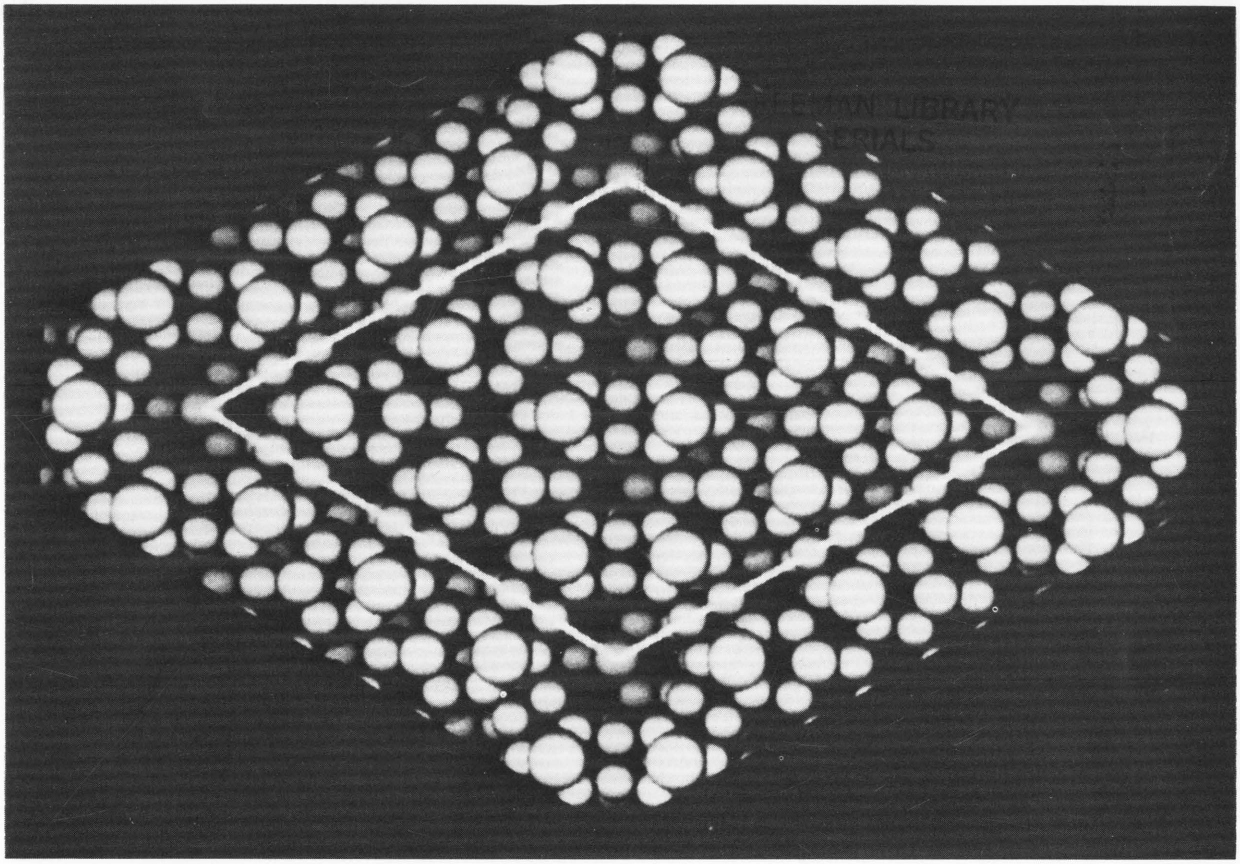

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The Computer-Driven Screen: A New Two-Way Medium for Mass Communications — *Jay Nievergelt, Andrea Ventura, and Hans Hinterberger*

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Communication with Expert Systems / Prof. Kathleen R. McKeown, Columbia Univ.
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(Source: announcement of Fall Joint Computer Conference of ACM and IEEE Computer Society, Infomart, Dallas, TX 75201, (800) 722-FJCC)

10 CHALLENGES FOR WISE PERSONS IN ARTIFICIAL INTELLIGENCE AND EXPERT SPELLING (List 861102)

Suffix	Examples
-an	historian, theologian, magician, publican, republican
-ant	savant, servant, knight-errant
-ee	employee, assignee, legatee, devotee
-ent	president, agent, regent, incumbent
-er	hatter, southerner, butler, teetotaler, writer, teacher, driver
-ess	princess, hostess, countess, ambassadress
-ine	heroine, concubine, divine, Clementine
-ist	artist, apologist, machinist, humanist, dramatist
-nik	filmnik, peacenick, no-goodnik, ideanik
-or	actor, creator, major, emperor

Note: The challenge is as follows: Given the word stem (like "history"), to determine the English word applicable for a person closely associated or connected with the meaning of that stem (like "historian"). See the above examples. For non-English speakers, the choice between "-er" and "-or" (and related choices) is quite difficult.

(Source: Neil Macdonald's notes)

6 APHORISMS ON PROBLEM SOLVING (List 861103)

One of the first rules in telling a lie is to tell a really good one, and be quite certain all the details are checked up. / - Chuck Tanner
Don't be rushed into making a lot of statements which aren't true; just stick to your story. / - Chuck Tanner
There's just as good fish in the sea as ever came out. / - Doris Brown
Never remember the past unless what you are remembering is happy or constructive. The past is gone; it is finished with. It is tomorrow that counts, never, never yesterday. / - Chuck Tanner
A man never wants for long anything that comes too easily. / - Madame Bertin
Men are all hunters at heart. / - M.B.

(Source: "Sweet Enchantress" by Barbara Cartland, published by Pyramid Publications, New York, NY, 1973, copyright 1958 by Barbara McCorquodale, 256 pp)

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Computing and Data Processing Newsletter

"STAR WARS" OFFERS A FLAWED "UMBRELLA OF PROTECTION"

Anthony De Blasi
Route 1, Box 99
West Newfield, ME 04095

(The following letter was sent to 12 newspapers, and was printed in the "Boston Globe" at least.)

I am a Korean veteran worried about the shape the arms race is taking. When President Reagan proposed the Strategic Defense Initiative (SDI) before his reelection, I supported it wholeheartedly. A system that destroys weapons instead of people, to be shared with the Soviet Union to guarantee stability during the arduous task of disarmament, this was a great idea.

In theory, SDI is safer than the deterrent of Mutual Assured Destruction (MAD). When it was announced I was unaware that even in its planning stage, SDI is seriously flawed.

The "umbrella of protection" against hostile nuclear warheads cannot be made leakproof. One out of 10 enemy warheads could penetrate the "shield" and home in on its target. During a saturation attack, this "defense system" would allow the obliteration of areas like Washington, New York, Los Angeles and other major population areas and strategic sites.

The destruction in Hiroshima and Nagasaki pale in comparison to just one leak in the proposed "shield." With hundreds, perhaps 1,000, greater-than-Hiroshima holocausts across America, what would there be left to defend?

The argument that SDI is 90 percent effective doesn't fly: we are not dealing with arthritis, or killer bees, or even AIDS, but with nuclear weapons. The built-in failure of SDI -- whether 10 percent or 1 percent -- is plainly unacceptable.

The insidious danger with SDI is that it gives a false sense of security while providing the enemy with an opportunity to exploit its weakness. A first strike under MAD is suicide, but under SDI it becomes an invitation. The odds, after all, of penetrating the "defense shield" are better than the odds of winning at a game of poker. And so SDI, while posing as a protective blanket, brings to the balance of terror a temptation to engage in nuclear adventurism.

But even if SDI could be designed to be 100 percent effective (which no scientist is ready to grant), the high-tech glitches and human errors that bring shuttle disasters and nuclear accidents would assure enough malfunctions to make living with SDI a nightmare.

To me, the fact that one malfunction could kill a million Americans shows that SDI is a colossal mistake.

That SDI is the brainchild of Dr. Edward Teller should come as no comfort. It was Teller who single-handedly pushed for the development and deployment of the hydrogen bomb. In one stroke that action committed the world to the most dangerous arms race in history.

It is time to halt the technocratic march of dangerous solutions. A practical first step is to say "no" to SDI and let that system -- which parades as protector of people -- tiptoe into dignified oblivion.

"LONDON UNDER ATTACK": A book by the GLAWARS (The Greater London Area War Risk Study), Blackwell, 397 pp, paperback, $7.95

Excerpt from a review by Paddy Ashdown in the June 19, 1986 "New Scientist," published by
IPC Magazines Ltd.
1-19 New Oxford St.
London, WC1A 1NG, England

This book is the report of a team of scientists, military experts, and disaster-relief specialists who were asked by the Greater London Council to establish how London would cope with an all-out attack, nuclear or otherwise.

The book's biggest strength and, paradoxically, its biggest enemy is its depth of detail and analysis. It will convince many people and may convert some. It is convincing because of the immense detail of devastation and it may convert perhaps even some of those of the "we came through the Blitz" persuasion.

(please turn to page 24)

Vol. 35, Nos. 11-12
November-December, 1986

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computers and people
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Computers and Global Problems

7 **The Danger Line That Is Never to Be Crossed** [A]
by Nikita Moiseyev, Academy of Sciences of the USSR, Moscow, USSR
System analysis, mathematical modeling and computerized calculations make it possible to foresee the results of global problems, like planet warming and nuclear war. Soviet scientists are independently using these methods to define and understand the "danger line" that threatens human existence.

6 **The Evolution of Dangers** [E]
by Edmund C. Berkeley, Editor
Measuring, studying, or evaluating modern dangers to our planet is likely to be fruitless unless intelligent and sympathetic minds in many governments can be found to appreciate and act on the information.

Computers and Communications

13 **The Computer-Driven Screen: A New Two-Way Medium for Mass Communications** [A]
by Jay Nievergelt, Andrea Ventura and Hans Hinterberger, Univ. of North Carolina, Chapel Hill, NC
The computer-driven screen has become a powerful, two-way, mass communications medium over the past couple of decades. Here is the story of how it developed, and of how it can become a "do-it-yourself" medium.

Computers and Social Change

18 **Microcomputers: From Movement to Industry** [A]
by Lenny Siegel, The Pacific Studies Center, Mountain View, CA
In the thriving world of microcomputer devotees and hobbyists there is still a powerful counter-culture that seeks to use computer technology to decentralize the control of information, question authority, and work for social change.

Artificial Intelligence

22 **Glass Annealing and Artificial Intelligence** [A]
by Cindy Griffin, Texas Instruments Co., Austin, TX
Annealing is a complex, usually trial-and-error process to relieve stress in suddenly cooled molten glass. Using only the real-world knowledge of an expert (and no theoretical equations), an expert system is constructed to simulate and plan for annealing in making glass objects.

Telecommuting

24 **Electronic Cottagers Unite** [N]
based on a report in the *Los Angeles Times*, Los Angeles, CA
The rights and the future prospects of telecommuters and electronic cottagers.

The magazine of the design, applications, and implications of information processing systems — and the pursuit of truth in input, output, and processing, for the benefit of people.

Information Systems and the Real World

27 The Gritty Interface between the Real World and Information Systems [P]
by Edmund C. Berkeley, Editor
This portion (page 1) of a new publication (4 pp in all) discusses some additional frustrating interfaces. Automatic program translation; finding streets and house numbers; . . .

28 Opportunities for Information Systems: Reading for Fun (Instalment 6) [C]
by Edmund C. Berkeley, Editor
A child's reading for necessity and reading for fun can be simply and easily accomplished using computer-assisted machines.

Computers and Nuclear Attacks

3 "Star Wars" Offers a Flawed "Umbrella of Protection" [N]
by Anthony De Blasi, West Newfield, ME
An umbrella, or a total defense system, that leaks, is really no protection at all.

3 "London Under Attack": A Book by the GLAWARS (Greater London Area War Risk Study) [N]
Excerpted from a review by Paddy Ashdown in the *New Scientist*, London, England
A view of how London would be unable to cope with an all-out attack, nuclear or "conventional".

Computer Applications

1,5 Atomic Surface of a Crystal of Silicon [FC]
by IBM Corp., Yorktown Heights, NY
A computerized representation of both the atoms and the bonds that hold them.

Lists Related to Information Processing

2 The Computer Almanac and the Computer Book of Lists — Instalment 50 [C]
8 Presentations on Natural Language Processing, from a convention announcement, Nov. 2-6, 1986 / List 861101
10 Challenges for Wise Persons in Artificial Intelligence and Expert Spelling, by Neil Macdonald / List 861102
6 Aphorisms on Problem Solving, by Barbara Cartland / List 861103

Computers, Games and Puzzles

28 Games and Puzzles for Nimble Minds — and Computers [C]
by Neil Macdonald, Assistant Editor
MAXIMDIDGE — Guessing a maxim expressed in digits or equivalent symbols.
NUMBLE — Deciphering unknown digits from arithmetical relations among them.

Front Cover Picture

The front cover shows a "picture" of the atoms (and the bonds that hold them in place) magnified some 30 million times in the surface of a crystal of silicon. Each side of the outlined rhombus is about 10 millionths of an inch long. The top atoms of the silicon crystal appear as large balls, with successively smaller balls representing atoms more deeply imbedded in the crystal. The "picture" is not really a photograph of what anyone can ever see, but a computerized representation of the enormously fast vibrations of the atoms in orbits. The photograph was obtained by IBM scientists using the IBM invention, the scanning tunneling microscope.

Computer Field → Zero

There will be zero computer field and zero people if the nuclear holocaust and nuclear winter occur. Every city in the United States and the Soviet Union is a multiply computerized target. Radiation, firestorms, soot, darkness, freezing, starvation, megadeaths, lie ahead.

Thought, discussion, and action to prevent this earth-transforming disaster is imperative. Learning to live together is the biggest variable for a computer field future.

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Type of Subscription

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Editorial

The Evolution of Dangers

Edmund C. Berkeley, Editor

If we should inventory the kinds of dangers that we (human beings) are susceptible to, we should find that the kinds of danger rise and fall, develop and decline, in other words evolve in response to various conditions.

For example, until 60 years ago, people in the United States died often from pneumonia. But now pneumonia has almost disappeared, because of new "miracle drugs" such as penicillin and tetracyclin. This kind of danger, we hope, is a receding one, although resistant strains of pneumonia bacteria are appearing. The success of new kinds of medical treatments makes us believe that similar great successes will be discovered for many other diseases not yet solved.

But there are a number of new kinds of dangers which are continually advancing. One of these is the danger that we, the present human inhabitants of the earth, will make changes in the biosphere (the spherical shell of atmosphere, soil, and ocean that holds almost all life) to such an extent that human beings will become extinct, like the dodo and the brontosaurus. There is as yet no international organ of governments and states which stands firmly for the interests of human generations that have not yet been born. The United Nations apparently has no Ombudsman "fighting" for the interests of persons living 100 and 1000 years from now. And national governments are regularly selfish and short-sighted.

Some of the new dangers (new in the sense that they have in the last 60 years become much more noticed) are the following:

- 1) the warming of the earth, because the burning of hydrocarbons puts carbon dioxide into the air and changes the heat balance of the planet earth;

- 2) the increase of radioactive waste, because of the use of nuclear energy for power and the complete failure to find safe century-long disposal for nuclear waste;

- 3) the gradual melting of the glaciers at the poles, the advance of the oceans inland, and the rise in sea level, because of heating;

- 4) the destruction of tropical rain forest as a result of the pressure of population to expand (and even explode); and more besides.

Computer scientists and academic organizations can study and project the approximate amount and speed of the changes in the various factors that relate to a kind of danger. Rough calculations are usually easy. More accurate calculations are much harder, because of difficulties of measurement, observation, and sampling. The resources of a large organization and a vast system of communication are required to detect an increase of 1/10 of a degree of temperature on the earth's surface.

Knowing a kind of danger, however, and knowing the action to be taken to deal with it, is rather different from convincing an international body of governmental officials to take action. Almost always, corrective action is hesitating, grudging, half-hearted, slow.

A good argument for action is "If you don't act soon, nothing at all will be saved; it will be too late." The rebuttal is "Not yet." But the argument requires intelligent, objective, understanding, and sympathetic minds to evaluate it. And this brings us back again to education and patience, in many, many people.

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The Danger Line That Is Never To Be Crossed

Nikita Moiseyev, Academician
Academy of Sciences of the USSR
Moscow, USSR

"Human acts can change the life-support conditions on this planet so much as to exclude the very possibility of the continued existence of civilization, at least as we know it today."

Reprinted with permission from ***The Danger Line That Is Never To Be Crossed*** in the August 1986 issue of ***Soviet Life,*** published by the Embassy of the USSR, 1706 18th St., NW, Washington, DC 20009, (202) 328-3237.

Outline

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5. Heat Balance of the Earth
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The Gaia system is an experimental facility -- a set of mathematical models of the biosphere -- that has been created at the Computer Research Center of the USSR Academy of Sciences. With some sophisticated, computer-based calculations, the system can accurately predict the reaction of the biosphere to any human agency that is growing in scale nowadays. The Gaia system and a model of nuclear war it has created help assess all the global consequences of the danger hanging over this planet and define the "danger line" that must never be crossed. Nikita Moiseyev, deputy director of the Computer Research Center of the USSR Academy of Sciences, gives an account of this program's research. Moiseyev is an authority on general mechanics and applied mathematics.

Opportunities Offered by Modern Science

A number of problems and difficulties are confronting human beings today, wherever they may live -- in Africa or in Europe, in large cities of America or in the tropical jungle. They concern everyone, and none of us can escape them. Humankind will have to devote all its intellectual energy to resolving these problems and to finding ways to avoid a possible crisis. Finding such solutions is crucial to the future of all of us, to the future of humanity.

I will describe the difficulties, the misfortunes and the possible disasters that lie ahead for humanity, but my concern is not to demonstrate the horrors of a holocaust. On the contrary, I want the reader to see the opportunities offered by modern science. Today science is capable not only of foreseeing the bottomless abyss toward which the human race may be heading, but also of indicating the way to avoid it. Any delay in the search for that way may be a real tragedy for humanity. One must always remember that possibility is not yet reality; the future has yet to be won. Humankind has yet to acquire a sense of commonality, a new morality and a new ethics.

Technological Revolution: Blessings and Misfortunes

Medical scientists, physicists and biologists have made great efforts to evaluate the aftermath of a possible nuclear war. The outright destruction and loss of life caused by blasts and radiation and the genetic consequences of radiation have been analyzed and discussed many times at international forums. But none of these discussions had precise, scientific evaluations to show that a nuclear war simply cannot have a more or less safe outcome.

It is necessary to explain to people, to demonstrate with real figures, that a nuclear war would be no war at all, that it would be nothing but self-destruction.

Reduced Rainfall on the Planet Earth

Human acts other than nuclear war can change the life-support conditions on this planet so much as to exclude the very possibility of the continued existence of civilization, at least as we know it today. For example, contamination of the ocean could result in decreased evaporation from its surface, which would, in turn, drastically reduce rainfall, already in short supply in most of the world. Reduced rainfall would decrease the food resources human beings have at their disposal. A 20 to 30 per cent reduction in food supply, combined with continued population growth, would have disastrous consequences that are even hard to predict today.

Consumption of Stored Energy on Earth

All the splendor of modern civilization has been produced by the tremendous amount of artificial energy that our power plants generate. We do not live off the energy of the Sun, as do plants and animals, but we expend the stocks of hydrocarbons -- oil, coal, gas and shales -- that have built up over hundreds of millions of years. We are fast consuming these unrenewable stocks. If our supply of these stocks were interrupted, the habitual course of our lives would be significantly altered.

A fair objection may be that the decreasing sources of hydrocarbon fuel will one day be replaced by nuclear fuel, that fast reactors are appearing, and that controlled thermonuclear fusion as a usable energy source is not far off. All that means unlimited reserves of energy.

Much of this contention is true. Fast reactors will certainly augment humanity's potential energy resources many times, and one may well expect thermonuclear fusion to be tamed before long. But something, indeed something very important, appears to be left out. Danger exists in the very amount of energy we use that comes from sources other than solar.

Heat Balance of the Earth

Today we are using increasing amounts of artificial energy. What happens to the heat balance of the biosphere as a result? This energy is dispersed, and it warms the Earth, the Earth's crust, the oceans and the atmosphere. However small such an "injection" of artificial energy into the Earth's thermal balance, it will inevitably cause the Earth's temperature to rise. If the amount of generated energy is measured in hundredths of a per cent of the influx of solar energy, such a warming of the Earth's climate is negligible. But energy production is increasing rapidly, doubling every 12, 15 or 18 years. It won't be long before artificial energy affects the planet's thermal balance. These conditions will result from the use of any energy of artificial origin, whether from thermal power plants or from thermonuclear fusion facilities. Solar energy alone does not alter the thermal balance.

Planet Warming

An increase in the planet's mean temperature of four to five degrees Celsius would result in ecological disaster. This is the danger line we cannot cross. Technological progress brings more than blessings. The power it gives humankind must be used properly.

The GAIA System, Begun 1972

An overriding objective of modern science is to create an instrument capable of detecting this "danger line" -- the frontier that humanity must not cross under under any circumstances. At the Computer Research Center of the USSR Academy of Sciences, we concluded in 1972 that a mathematical model of the biosphere seen as a single unit could help to resolve global problems. Creating such a model is an important stage in the development of theory. The model must be capable of explaining the observed facts. But that is not enough. A good theory, physicists say, must be able to "see around the corner";

that is, it must be able to predict facts we do not yet know or even guess about.

Mathematical Models of the Biosphere

The first step toward creating such a theory was to make a system of mathematical models of the biosphere, an experimental facility that would make it possible to study the biosphere's reactions to human acts and eventually to discover the "danger line," the allowable limit.

The first variation of such a model had been finished by the late 1970s despite numerous difficulties. The model consisted of two interrelated model systems. One system described the processes occurring in the atmosphere and in the ocean; the other described the behavior of the biota, the entire biological community of the Earth. In fact, the latter model described the circulation of matter (carbon, above all) in nature, taking into account plant activity. Our model does not take into direct account animal activity because its contribution to the biosphere's energy balance is very small (less than 10 per cent).

Usability of the Model

The second requirement for our model system was its usability. By setting a definite course for human activity to follow, we must gauge, by computer, the changing state of the biosphere. The model had to be rather rough, yet fairly accurate. It had to distinguish the climate of the Volga from that of Central Russia and the plant growth process in the Amazonian selva from similar processes in the Siberian taiga.

It has taken years of work to "adjust" the systems for test situations. Participating in this work were the staff of the Computer Research Center with the assistance and advice of many institutes of the USSR Academy of Sciences, such as the observatory of the Geophysical Institute, the Soil Institute and the Institute of Geography, to mention just a few.

Our system has been named "Gaia," after the goddess of the Earth. This name is more appropriate than "model of the biosphere." We began major experiments with the Gaia system in 1982.

Possible Warming: What Can It Do?

We cannot foretell the future of humanity with the Gaia System; all we can do is investigate the consequences of various options of human activity by modeling them. Therefore, we must plot our experiments to see what would happen if humankind did this or that.

One of the problems now concerning scientists relates to the growing concentration of carbon dioxide in the atmosphere. This concentration produces a hothouse effect, raising the mean temperature of the atmosphere and changing its distribution over the Earth's surface, thus influencing the transfer of masses of air and changing the transfer and circulation of moisture. Consequently, the conditions of life change, and so does the productivity of vegetation.

Arid Zones Becoming Still More Arid

This is a vexing problem for scientists, of course. Carbon dioxide concentration has substantially increased throughout this century. It will have doubled by the end of the first quarter of the twenty-first century. Such an increase may appreciably alter the average temperatures of this planet. This warming trend will reduce the temperature difference between the equator and the poles, the main motor for atmospheric transfer of heat from the equatorial zones to the polar regions. Whenever the temperature differential widens, the intensity of atmospheric circulation increases. With the difference reduced, atmospheric circulation lessens, and the rate of moisture transfer decreases. Consequently, the arid zones become still more arid and the productivity of the biota falls off.

Scientists cannot predict which of the two trends will gain the upper hand. This must be resolved.

The first major experiment we executed with the Gaia model aimed to find out how the productivity of the biota would change (zonally) as the concentration of carbon dioxide in the atmosphere doubled. That is to say, the pattern we chose implied that the amount of mineral hydrocarbons -- oil, gas and coal -- burned would double the quantity of carbon dioxide in the atmosphere.

The Gaia model experiment has largely borne out this line of reasoning. In areas of adequate humidity, the productivity of the biota would increase, but at the same time, a wide range of arid zones and semideserts would apparently be in danger of desertification. Those expected to suffer most would be the areas south of the Sahara in Africa and Western and Central Asia. Some areas of

Europe and the western regions of North America would find themselves advantaged. On the whole, however, the aggregate productivity of the biota would hardly change at all. Such calculations may also have direct practical significance for agricultural production.

So our first major experiment showed that the mathematical Gaia model had become a reality. It set the stage for a further very important research study of the climatic consequences of a nuclear war. We carried out this experiment in 1983.

The Truth Must Be Faced

The truth must be faced; reality must be known for what it is. Now, the most important thing is to avoid being deluded into thinking that the storm will pass by without doing us any harm. Only a clear understanding of an impending danger makes humankind strong, helping us to find the right way out of crises and the energy to fight for those solutions. In short, we must imagine the likely scenario of a nuclear war, which is still possible, alas.

At the beginning of the 1980s, scientists who were anxious to avoid nuclear war began to study the conditions in which it could occur. In 1982 "Ambio" magazine published a series of possible scenarios and estimates of the damage the potential parties to a nuclear conflict could sustain.

Prof. Carl Sagan of Cornell

The next step was taken by Cornell University Astronomy Professor Carl Sagan and his staff. Basing their experiment on the calculations of Professor Krudzen of the Federal Republic of Germany, they made the first assessment of the effects of a nuclear war on climate and the biota.

Sagan's group looked into a whole series of scenarios. The scientists found that the most probable scenario, if one may speak of probability at all in this context, was a nuclear war in which the adversaries exchanged strikes totaling 5,000 megatons: that is, roughly, between 400,000 and 500,000 bombs like the one dropped on Hiroshima. They called that a base scenario.

The amount of nuclear fuel that would be spent according to this base scenario would be enough to incinerate about a thousand big cities of the Northern Hemisphere. The scenario revealed that a vast area of the Northern Hemisphere would be under virtually impervious clouds of soot in the opening hours of the war, and they would be very slow to clear up. Not even a year after the disaster would the state of the Earth's atmosphere return to normal.

Testing Sagan's Scenarios on the GAIA System

As soon as we received Sagan's scenario and the tentative estimates of American experts, we got down to "playing" a major mathematical experiment on the Gaia system.

The staff of the Computer Research Center set the Gaia system working to figure out what climatic changes a nuclear war could precipitate, with the starting data taken from Sagan's scenario. Calculations were carried out on a BESM-6 computer in the summer of 1983.

The findings were staggering, compelling us to take an entirely new look at the possible consequences of a nuclear war. They revealed clearly that nuclear conflict would bring on not only some local cooling-off and darkness under the pall of isolated soot clouds, but a global nuclear night about a year long. The computer said the Earth would be shrouded in darkness. Hundreds of millions of tons of earth lifted into the air, the smoke of continent-wide fires, the ash and most of all the soot coming from burning cities and forests would make our sky impervious to sunlight. Patches of soot clouds would progressively merge into one, and six to eight weeks later the whole of the Earth would be wrapped in a dark, practically impervious blanket.

Just a few weeks after the nuclear blast, the mean temperature of the Northern Hemisphere would fall by 15 to 20 degrees Celsius below its ordinary level. In some places, such as Northern Europe, the temperature would drop by 30 degrees. On the East Coast of the United States and in the central regions of Siberia, the temperature would drop even more, falling 40 to 50 degrees.

Cooling in Southern Regions

The cooling would affect southern regions even more adversely. In Saudi Arabia, for instance, the temperature would fall off by 30 degrees Celsius and more by the end of the first month after the nuclear disaster. Subsequently, as the blankets of soot consolidated, the cooling would spread into the Southern Hemisphere, too. The temperature would drop by 15 to 20 degrees Celsius in the equatorial zone, and it would become even colder in the Antarctic. The entire atmospheric circulation would be reversed, making temperatures just as cold in the Arabian Desert and in the Sahara as in the Antarctic. Temperatures on the mainland of the equatorial zone (tropical forests of Africa and the Amazonian selva) would everywhere be below zero. The only place temperatures would remain above zero is the ocean.

Everything would change in the wake of a nuclear disaster. The upper atmosphere (at the tropospheric boundary) would be heated up to 100 degrees Celsius, while the temperatures at the Earth's surface would be well below zero. Such a temperature distribution would make the atmosphere far more stable than it is now. Convective transfer would disappear, so removal of soot from the atmosphere would be slower than the original scenario presumed.

The characteristics of the "nuclear night" and the "nuclear winter" in the first months after the blast would begin to change only very slowly. Only by the beginning of the fourth month would the clearing begin, and that process would be very slow, too.

Violent Storms in Coastal Areas

Instability would be yet another concomitant of the "nuclear winter." We have already noted that the temperature of the ocean's surface would decline relatively little. An immense temperature gap would develop between the land and the ocean and between the air and the water. One can well imagine the unprecedented storms this condition would cause in coastal areas.

At the Computer Research Center we figured out the processes that are bound to occur in the atmosphere and in the ocean for 380 days after the nuclear disaster. We have found that not even a year later would the atmosphere become quite clear again. Its state would still be very far from the present, stable state. A nuclear strike would revamp the biosphere. We cannot yet say for sure in what state it would be and whether or not the Earth would be habitable at all for whomever may remain of the human race.

The calculations we made in 1983 have been repeated again and again. The model has been constantly improved, but the results have remained practically the same.

Further calculations made in 1984 showed that even if a nuclear war involved no more than 100 to 150 megatons of nuclear fuel (that is, one-fiftieth of what was presumed in the Sagan scenario), the strikes would involve the principal cities of Europe, Asia, and America, and those cities would burn down in whirlpools of fire. The clouds of soot would still be large enough to bring on a "nuclear winter." The only difference would be that the aftereffects would end within months, rather than within a year. Yet even that would be quite enough to tax human life on Earth.

Many Various Mathematical Experiments, All Agreeing

I want to stress that in the mathematical experiment we made many calculations of all kinds, we varied parameters within tolerable limits, we "changed the yield" of possible nuclear strikes by various multiples; but the basic conclusion remained unchanged -- a "nuclear night" would last for months on end after a nuclear war, bringing with it a "nuclear winter" that would freeze the Earth, including its sources of fresh water. Nobody, wherever they might live, would survive that nightmare.

American Calculations

A serious scientific analysis of the consequences of nuclear war, including the effects on the climate, has attracted the attention of scientists of many nations. A similar study was carried out in the United States in 1983. The American model, prepared by the Climatic Research Center, differed substantially from ours. That was natural; we knew nothing about each other's research, and we did it in different ways.

American scientists explored only atmospheric movements. As far as these were concerned, their model was appreciably more accurate than ours. But the Soviet Computer Research Center's model described not only the atmospheric phenomena themselves, but also the interaction of the atmosphere and the ocean. That interaction determines, above all, the power charge of the atmosphere. A study of the long-term consequences cannot ignore the transfer of heat from the ocean into the atmosphere.

The American calculations take into account only the first 24 days following the catastrophe. Estimates that begin at the end of the first month after nuclear fires had broken out cannot disregard the influence of the ocean. That reservoir of heat appreciably alters the pattern of atmospheric circulation and, of course, moderates the rigorous conditions of a "nuclear winter." But the temperature gaps that develop between the atmosphere and the ocean would have many effects. The Soviet study investigated these effects because the Gaia model allowed us to make calculations for the equivalent of around a year after the disaster.

US and USSR Predictions Coincide

Soviet and American experts, working independently, applying different models and using different computer facilities, have made very similar findings. The predictions for the first month of a "nuclear winter" obtained at the U.S. Climatic Research Center have practically coincided with those resulting from the Soviet study. The two studies also produced very similar estimates of the extreme temperatures and their distribution over the Earth's surface. Humanity now has a new idea, based on precise scientific data, of what a nuclear war would mean to it.

Humankind Could Not Possibly Survive

With the findings we have obtained about the climate, we can relatively easily evaluate the ecological aftermath of a nuclear war. Since the temperature on the mainlands would practically everywhere fall below zero degrees Celsius, all sources of fresh water would freeze and crops all over the globe would be destroyed. Radiation intensity would by far surpass fatal levels on vast territories. Humankind could not possibly survive under the circumstances. Even if some groups survived because they had found shelter in special bunkers or because they lived on some out-of-the-way islands in the equatorial zone of the world's oceans, their days would most probably be numbered in the desert that the whole of our planet would have become.

Some scientists have estimated that the ozone layer, which absorbs hard solar radiation (ultraviolet rays) today, would be almost totally destroyed. The loss of this protection would add to the background radiation that would be fatal for all living things, and especially for human beings.

A Nuclear Strike Would Bring Its Own Retaliation

A nuclear strike would thus precipitate its own retaliation. No matter who initiates the first strike, no matter where on this planet it occurs, and no matter whether the nation that is attacked retaliates, it's likely that nobody will survive the disaster. So the person who presses the button will have the same fate in store as the inhabitants of the cities under attack.

Somebody has called the Soviet and American research findings, which were first announced at the 1983 World After Nuclear War Conference, an "antinuclear bomb." That "antinuclear bomb" should, it seems to me, be used to the hilt. Science must make clear to everybody that nuclear war would mean an end to human life on Earth.

Reason is Becoming a Party to Evolution

At the beginning of this article I referred to the fast-growing power of civilization and the perils that lie in wait for it. Power must be used sensibly. A nuclear war is just one example of an unreasonable and infinitely dangerous way of using that power to resolve human conflicts. But it is certainly not the only way to make humankind's continued existence highly problematic.

All indications point to the fact that humanity is, indeed, on the threshold of that stage in the evolution of our planet that we now call the period of the noosphere. We must understand that reason is becoming a party to the process of evolution, a party that, however powerful, must obey the general laws of evolution. So in such circumstances, taking into account all the restrictions and barriers that are appropriate to nature, we must speak of a directed development of the biosphere.

The Computer Enables Foreseeing Evolution

Studies have shown that the contemporary means of system analysis, mathematical modeling and computerized calculations make it possible to foresee what path evolution will follow depending on the kind of action that is taken.

Soviet and American research has produced some findings of even greater significance. It has, in fact, identified one of the points of the "danger line." Now we know what amount of soot, once ejected into the atmosphere, could wipe out the human race altogether. Nuclear weapons may not be the only cause of an impervious pall of black soot. Something like a "nuclear night" or "nuclear winter" effect could also arise from the use of "conventional" weapons, which now have hundreds or perhaps thousands of times the destructive power of earlier types of weapons. So the research studies made by Soviet

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The Computer-Driven Screen: A New Two-Way Medium for Mass Communications

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"You don't talk back to newspapers, radio, or television. ... But you do talk back to a computer-generated dialog, and you insist that it proceed according to your wishes."

Based on Chapter 2, *The Computer-Driven Screen: An Emerging Two-way Mass Communications Medium* in *Interactive Computer Programs for Education: Philosophy, Techniques, and Examples* by Jay Nievergelt, Andrea Ventura, and Hans Hinterberger, Univ. of North Carolina at Chapel Hill and ETH Zurich, published by and copyright 1986 by Addison-Wesley Publishing Co., Reading, MA 01867, 190 pp. Reprinted with permission.

Traditional Mass Communications

Traditional mass communications media accept no feedback from the viewer or listener. The computer-driven screen is emerging as the only two-way mass communications medium we know -- a medium for dialogs rather than monologs. More and more people work or entertain themselves with this medium, which promises to become very widely used. But, so far, very few people have had time to become experienced authors of man-computer dialogs, and the possibilities and limitations of this new medium are poorly understood.

Media and Their Characteristics

Throughout history, communicators had to choose between two mutually exclusive modes of communication: either conducting a dialog with one or a few partners, or delivering a monolog to a large audience. The person-to-person meeting, the telephone, or an exchange of handwritten letters support the individual dialog. The microphone, the book and newspaper, the copier, radio, and television -- indeed, most of the media created by technology in recent centuries -- enable and encourage the mass monolog. The availability of cheap mass media undoubtedly has had profound effects on society as a whole and on every individual. For better or worse, it has given some public figures a visibility and influence throughout the world that would have been inconceivable earlier. It has made certain kinds of knowledge and entertainment easily available to anybody who has the interest and time to look and listen. One of the first to realize the impact of mass media, Marshall McLuhan, introduced the notion of the "global village" to emphasize the effects this quick distribution of information has on our lives.

But are cheap mass media really turning the world into McLuhan's global village? An essential aspect of a village's social life is the active give-and-take of two-way communication. The monologs delivered by today's cheap mass media have perhaps encouraged a passivity among the population at large, whereas the less powerful communications gadgets of older times forced our ancestors into creative activity. Why sing or play an instrument when stereo equipment pipes professionally produced sound into your living room? Why practice the art of story telling when you know that you will never be able to compete for your children's attention against dazzling TV shows, produced at a cost of millions of dollars to spellbind viewers?

Reaction to the "Mass Monolog"

In recent years we have begun to see a reaction against the dominating role of the "mass monolog" in our lives, and a revival of the "back-to-basics" syndrome. Such a trend can perhaps be seen in the increasingly popular desire to renounce some aspects of our technological society, and to return to a "simpler" lifestyle. But it can also be seen in the increasing exploitation of even more recent technological advances that give amateurs access to media previously available only to professionals. Just as the camera developed from a bulky, costly piece of equipment for professional photographers to today's instant snapshot device, the video camera may turn the TV into a do-it-yourself workbench for hobbyists. And the personal computer may turn many of us into media producers, just as writing has turned all of us into readers and writers. That's what this book is all about.

As yet our society is generally unaware that over the past couple of decades a powerful new medium -- the computer-driven screen -- has come into existence. Everyone is aware that the computer exists, but few recognize it as a communications medium. As such, it is unusually powerful: it is the only two-way mass communications medium we have. It allows two-way communication between user and author of the dialog. You don't talk back to newspapers, radio, or television. If you do, at least you don't expect them to react to your outburst; there is no feedback. But you do talk back to a computer-generated dialog, and you insist that it proceed according to your wishes. "Show me that picture again," "go slower," "skip these explanations for the time being," "what else do you have on this topic," "I want more detail on this figure," and "remind me of this fact again tomorrow" are examples of the feedback that a good man-machine dialog can accept today, but usually doesn't. Of course, man-machine dialog is not symmetric; the two partners do not play the same role, nor do they have the same capabilities. We do not have Socrates sitting at the other end of a log when we converse with a machine. We have a dialog partner who can call upon large collections of data and long computations extremely accurately, but may be devoid of intuition, insight, wisdom, and creativity -- properties that we hope the human partner will bring to the dialog. Let us briefly survey some highlights in the development of this new medium.

From Calculator to General-Purpose Man-Machine Interface

Electronic computers were developed toward the end of the second world war to solve technically straightforward but tedious problems such as ballistic trajectory computations. Put a few numbers in, calculate for a long time, print some out. The next major step was using computers for business data processing, such as payroll or monthly inventory reports. Now the usage pattern changed: read a lot of data, calculate a little, print a lot. The bottleneck became input/output, rather than the central processing unit.

The third big step was the advent of time-sharing, which attached terminals to a computer and put the user "on-line." The computer started to pay attention to individual commands as they were entered, thus making a man-machine dialog possible. Nobody thought of these terminal-oriented computer systems of the 1960s as media. They were used almost exclusively to enter and execute programs, and they used teletypes or alphanumeric displays with capital letters only.

The latest, but certainly not the last, step on the way to transforming a calculating machine into a medium is the recent availability of affordable single-user desktop computers with graphics screens.

- Affordable: The cost ranges from a few thousand dollars for hobby computers to ten times as much for a useful professional workstation.

- Single-user: It's your personal working tool; you don't depend on costly communication links to a computer center that closes at certain times.

- Graphics: Much of today's communication relies on pictorial material; the spoken or written word alone is on the retreat. Thus a computer must be able to present pictures as well as other media do.

The number of people who work or entertain themselves with this new medium, the computer-driven screen, is small, but increasing. Undoubtedly the medium will become very widely used simply because many office jobs are being performed with interactive computer systems: information and reservation systems, computer-aided design, and computer-aided learning. We are justified in calling the computer a medium, rather than just a tool, because of its universality. Interactive systems may start out as special-purpose machines designed for one job, but they soon develop into "integrated systems" that offer a variety of services: on-line manuals for operation and training, message systems and news services, text and picture editors, and games.

Man-Computer Dialogs

As yet relatively few people have experience in writing man-computer dialogs, and few fully grasp the possibilities and limitations of this new medium. It is evident, however, that today's man-computer dialogs do not come close to exploiting the communicative possibilities of the computer-driven screen. The teletype-like terminals of early computer systems stultified man-computer communication styles: the inability to program dynamic two-dimensional layouts on these old scrolling devices is responsible for much of the linear style of today's computer output. Graphics terminals of even modest cost can provide the means with which to experiment on how to use the dynamic page effectively. In this respect, the wide availability of single-user computers is a great advantage. Whereas access to other media is usually restricted to professionals, the computer-driven screen is equally accessible to professionals and hobbyists. The lively trade of dialog programs among computer hobbyists during computer exhibits attests to this.

Using the computer-driven screen as a demonstration aid in education deserves to be singled out. The demonstration of processes evolving in time has usually been difficult. In physics or chemistry, for example, an experiment may evolve so rapidly that the unaided human senses cannot follow it; in genetics, so slowly that we cannot wait. Educational films may show the process at a speed appropriate to the viewer, but typically they must be produced professionally. And the question "what happens if we change this condition a little?" cannot be answered pictorially without producing a new film. The computational power of the computer can often be used to realize a simulation model of the phenomenon of interest, from which processes under arbitrary initial conditions can be executed and displayed under controlled speed. Teachers with programming skills may feel like movie directors who can change the script as they go along. The film will not have the professional polish of a TV show, but the intimate knowledge the teacher has as its author will more than make up for this.

How People React: Some Facts, Some Speculations

How is a person affected by sitting in front of a display all day long? This is a question of justifiable concern to office workers who find their pens and paper pads, file cabinets, in- and out-baskets, and even the telephone increasingly being replaced by a versatile computer that can act as a writing and drawing tool, a storage and retrieval system, a scheduler of activities, or a message system. "If you plan to work, start by sitting down at your computer." This motto is true in many programming environments today, where people loaf when the machine is down because no useful work can be done without it. The motto will become true for increasing numbers and types of office workers -- design engineers, information desk personnel, writers, and secretaries. The advice or regulation to limit the number of hours spent in front of a display to a few per day will not work unless one also limits the number of working hours to a few per day or rotates jobs. Whereafter many people probably would spend additional time with their own home computer, just as they do with television today.

We should understand the effects of prolonged work or amusement at a display station, but we probably will not until it has been tried by many more people for many more years. And until this experience has accumulated, our new medium will undoubtedly be overused and abused, as other innovations have been (and not just technological innovations). The quality of man-machine interaction is best discussed with respect to three separate aspects: physiological, psychological, and logical. Let us venture a few comments about each.

Physiological Aspects

The study of the physiological component of man's interaction with machines has a long history, going back at least to Frederick W. Taylor, who in the 1880s systematically analyzed industrial work processes with the goal of increasing productivity. Although Taylor is often decried as a creator of the assembly line, which transformed many a creative craft into dull repetitive work, he started out pursuing social rather than engineering or profit objectives. His hope -- fulfilled to a remarkable extent in industrialized countries -- was to give the laborer a decent livelihood through increased productivity. And that requires a workstation adapted to human physiological needs. Today human factors engineering, or ergonomics, has begun to study the physiological requirements specific to the computerized workstation. This includes the design of various input devices, such as keyboards, light pens, joysticks, and mice, but it is mostly concerned with the channel of largest bandwidth between user and machine, namely the display screen. Two rules of thumb that the computer still has to learn are: Avoid flicker effects and avoid stark contrasts in brightness.

Flicker is mostly a hardware phenomenon of poor quality CRTs or insufficiently powerful display processors. It can be avoided, and this perhaps is an area where regulation on health grounds is appropriate. Display technologies that produce no flicker at all, such as the plasma panel, should be used on a larger scale. Some flicker effects are created by bad programming practices such as excessive use of scrolling -- a habit dating from the days of teletypes that should be abandoned.

Stark contrasts in brightness within the visual field are tiresome because the eyes keep adapting from one level of brightness to another as they wander across the screen. The practive of highlighting certain portions of the screen by writing in inverse video, which is appropriate from the logical or systems design point of view, is questionable on physiological grounds because it produces areas that are much brighter than others. It is better to distinguish different zones on the screen by means of different colors of approximately the same level of brightness. Many inexpensive hobby computers are designed to work on standard color TVs or special color monitors, and it is only a matter of time until the more expensive terminals of the established manufacturers will have the color capability, too.

Psychological Aspects

Is prolonged interaction with a machine dehumanizing? Does it erode human contact? These questions are often raised, particularly in discussions of computer-assisted instruction, where the notion of replacing a teacher by a machine is apt to raise deep anxieties in some people. Observations of thousands of students involved in prolonged CAI (computer-assisted instruction) activities have led us to the conclusion that such fears are greatly exaggerated -- a sensible management of the computerized activity, which leaves people a fair amount of freedom to get away from the machine once in a while, should allay them entirely.

Is prolonged interaction with a machine dehumanizing? Books, chalkboards, and laboratory equipment are also machines. They do not raise any fears (did they when they were first introduced?) mostly because they are passive -- they respond to human initiative, they do not drive the person using them. Computers often have the image of slave drivers, just as the assembly line does. People sometimes like to be driven, particularly when the activity is enjoyable (just watch somebody glued to a TV set or pinball machine). But being driven can evoke the strongest reactions when we resent this control. Interaction with a machine is not necessarily dehumanizing; it is only when the machine starts bossing us around that we lose our dignity.

An assembly line that feeds tasks to a laborer at an excessive rate, or a computer that forces you to answer ten irrelevant questions before you can do your own thing, are examples of machines that provoke opposition. Programmers of man-machine dialogs should avoid such problems by giving the user control of the dialog most of the time and the option of regaining control at all times. This attitude was best expressed by a student who insisted on playing games of skill on a CAI system instead of the drills he was scheduled to do: "I hate machines that tell me what to do. I want to tell them what to do!" An author of instructional material should accept this statement as a challenge.

Machine vs. People Interaction

Does prolonged interaction with a machine erode human contact? Yes, to the same extent as preoccupation with anything impersonal takes time that might have been spent interacting with people. But when bored with the impersonal task, users of a computerized workstation can always swivel their chairs and try to catch a neighbor's attention. Classrooms equipped with a few dozen terminals or personal computers invite a much more lively social life than would be possible in a conventional setting, where the teacher has to be heard by everybody. Replacing the "one-to-many" type of monolog necessitated by traditional media with many "one-to-one" interactions fosters individual activity of all kinds, intellectual as well as social. There is an optimistic answer to the question at the beginning of this paragraph: There is no reason why interaction with a machine should interfere with human contacts; to the extent that computerized workstations allow many people to work at their own pace, rather than being locked into somebody else's schedule, they give us the possibility to design new working environments that are less formal, and potentially friendlier.

In connection with a project called ACSES (Automated Computer Science Education System), several thousand students who took their first programming course at the University of Illinois, partly on the Plato CAI system and partly in the conventional lecture mode, were questioned extensively about their acceptance of computer-assisted instruction. Their basis of comparison, the large-classroom lecture where a hundred students listen and take notes, is perhaps not the greatest educational invention, but it is a common practice for introductory courses in many large schools. The overwhelming majority of students, better than 80 percent, preferred

Plato to the alternative. Stated advantages were:

- The possibility to use the machines at most times of day or night, as opposed to the strict schedules of the lectures.

- Proceeding at one's own pace.

- The personal freedom possible in the Plato classrooms, as opposed to the discipline required in the lecture halls.

Systems Design Aspects

Peoples' reaction to a machine depends first on what they expect to get out of it, be it fun or profit, and second on the difficulty of using it. Professional users are often sufficiently motivated by the expected result of using the computer to put up with atrocious man-machine interfaces, whereas casual users who do not depend on the machine will walk away if operating the machine is difficult or inconvenient to learn. The saying "the cobbler's children go barefoot" often applies to computer technologists, who have become familiar with cryptic command languages, whose "/*$ -syntax" can only be explained by historical accident. In CAI or in hobby computers, where casual users do have an alternative (books or lectures in the first case, other forms of entertainment in the second), the logical quality of the man-machine interface is often more advanced.

How Should a Machine Present Itself?

Observing the behavior of casual users has provided much insight into the fundamental design question of how a machine should present itself to the user. Most of the recurring difficulties of a novice are summed up by the following questions:

- Where am I?	(when the screen looks different from what you expected)
- What can I do here?	(when you are unsure about what commands are active)
- How did I get here?	(when you suspect you pressed some wrong key)
- Where else can I go?	(when you want to explore the system's capabilities).

We are beginning to learn that the logical design of an interactive system must allow the user to obtain a convenient answer to the preceding questions at all times. In other words, the man-machine interface must include queries about the state of the system (without changing this state), about the history of the dialog, and about possible futures. This principle is much more important for today's computerized machines, "black boxes" that show the user only as much about their inner workings as the programmer decided to show, than for mechanical machines, which by visible parts, motion, and noise continuously give the user a lot of state information. The next section gives some examples of dialog design principles.

Authoring Man-Machine Dialog

Today's man-machine dialogs are full of elementary design errors: poor layout of information on the screen, screens crowded with irrelevant information that makes it hard for the user to extract the one line where an important change has occurred, dead ends where only a panic exit is active (which may destroy recent information), poor choice of encoding logical commands by key presses (so that frequent commands turn out to require many key presses, and dangerous ones such as "delete" are enabled by a single key press).

We attempt to classify such errors and develop rules for avoiding them in a following section. At this point let us simply state our belief that this superficial aspect of the quality of dialogs will not remain a hindrance to the spread of instructional use of computers for very long. Once the computer-driven screen has become familiar to most programmers as a medium of communication, the most obvious rules of good and bad style will become common knowledge. Dialog programming can be learned, and a major purpose of this book is to show that a concise collection of do's and don'ts in dialog design can make a difference.

Any discussion on the practicality of computer-delivered instructional dialogs must address the question: How much work does it take to produce an hour's worth of dialog? Estimates vary wildly from a ratio of over 1000:1 of author-time to user-time, down to 10:1. Both figures can be correct, depending on the circumstances. If we think of courseware, or any type of man-machine dialog, as a commercial product with all the embellishment and overhead that implies, then costs of production will be similar to those of today's film or television.

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Microcomputers: From Movement to Industry

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"In the thriving world of microcomputer devotees and hobbyists there is a still powerful counterculture that seeks to use computer technology to decentralize the control of information, question authority, and work for social change."

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An Odd Marriage

The microcomputer is the child of an odd marriage between the military industrial complex and counter-culture hackers from the fringes of the new left. /1/ Ironically, this product of the anti-authoritarian visions of its inventors has become the darling of financiers and a symbol of the hope of the renewed dynamism of U.S. capitalism. The history of the microcomputer industry is thus a case study in both the constraints on innovation within large capitalist firms and the ability of those firms to coopt and control the products of renegade inventors. It is also the story of the creative energies unleashed by the liberatory impulses of the late 1960s, and the idealistic but fallacious belief that technical innovation per se can challenge the centralization of information and power, and the foundations of capitalist rule.

The Origins

Scientifically, the microcomputer represents a series of gradual developments rather than a sudden breakthrough. During the Second World War teams sponsored by the military and intelligence agencies in the United States, Germany, and Britain developed the first digital computers. After the war, orders from the Pentagon, the Census Bureau, the Atomic Energy Commission, and other government agencies propelled the private sector to develop increasingly complex computers. Initially the circuitry was based on vacuum tubes, which were bulky and unreliable. A 1950-vintage machine with as much computing power as the word processor on which I am typing was the size of a room, broke down several times a day, cost millions, and required many full-time attendants. Early on, IBM established a dominant position in the computer industry, accounting for three quarters of worldwide sales during the 1950s and 1960s.

In 1947, scientists at Bell Laboratories, the research arm of AT&T, invented the transistor, which eventually replaced the vacuum tube and opened the way to more reliable, smaller, and cheaper machines. This invention evolved directly from solid state physics research sponsored by the military. The Pentagon continued to play a critical role in the development and dissemination of semiconductors throughout the 1950s and 1960s by sponsoring research and providing the major market for the resulting products. /2/ IBM quickly incorporated the new technology into its machines, and by 1960 had become the largest non-military customer of virtually every U.S. semiconductor manufacturer.

Manufacture of Semiconductor Components

In contrast to the computer industry, which was dominated by IBM, the manufacture of the semiconductor components of computers (and other electronic equipment) was intensely competitive. Major electronics firms, such as GE, RCA, and Sylvania, chose not to invest heavily in semiconductors that competed with and undermined their existing product lines of vacuum tubes, leaving an opening for smaller newcomers such as Texas Instruments (TI) and Fairchild Camera. In the late 1950s engineers at TI and Fairchild invented the integrated circuit, which combined many transistors on a single chip of silicon, allowing dramatic decreases in the size and cost of electronic components. These tiny, cheap, powerful circuits made possible devices that had hitherto been unthinkable, and inspired the imagination of the firms' engineers. This blossoming of technical possibilities, combined with the relatively small amount of capital then needed to manufacture integrated circuits, led to a proliferation of new electronics companies, many of them in California's "Silicon Valley." The low cost and small size of components made them practical not only for military and industrial hardware, but for consumer electronics gadgets as well. Japanese firms gained a large share of the consumer electronics market, starting in 1957 with the export of transistor radios, though U.S. firms continued to dominate the world semiconductor market until the late 1970s.

The First Microprocessor: A Japanese Order

If any single invention marked the eclipse of the Pentagon's hegemony over high-tech electronics, it was the microprocessor. While the military purchased 70 percent of all integrated circuit production as late as 1965, it was an order from a Japanese calculator manufacturer that inspired engineers at Intel (a small Silicon Valley firm spunoff from Fairchild) to design the first microprocessor. This device combined the circuits of a programmable computer on a single silicon chip that could be mass produced for a few dollars. As Regis McKenna, the public relations whiz for Intel (and later Apple) pointed out, the "second generation" microprocessor (the 8080, which was the "brain" of many early microcomputers) was marketed by Intel in 1974, second-sourced by Japan in 1975, copied by the Soviets by 1977, and finally purchased by the Pentagon in 1979.

The Electronic Counterculture

The low cost of these increasingly powerful electronic components made them accessible to students and hobbyists as well as engineers. Radicals in revolt against authoritarian, centralized power structures symbolized by Ma Bell and the "Almighty IBM Machine" began to conceive of electronics as a weapon that could be turned against authority. Bill Gates, who later wrote programs for the first commercial microcomputer and conceived of the design for the IBM personal computer (PC), proved his smarts by simultaneously "crashing" all the computers in Control Data Corporation's national Cybernet network. "Phone freaks," among them future founder of Apple Computer Steve Wozniak, built and sold electronic devices (so-called blue boxes) to bypass the AT&T electronic billing system.

For a time, the high cost of computer components limited hobbyists to crashing corporate machines. The introduction of Intel's 8080 microprocessor on a chip in 1974 made it possible to build one's own. Basement hackers began to fantasize about small computers as common as telephones, which would decentralize control over information, and hence power. One of the editors of "The Whole Earth Catalog" later laid out the computopian view of city politics:

"Imagine how many people would speak out if they didn't have to occupy a precious evening by crowding into a public hearing room -- if, instead, they could sign into a [computer] network several times a week, see the city's arguments, and raise their own without time pressure or the adrenaline flow that comes from speaking to a crowd. Imagine the heightened level of democracy in San Francisco if the channels of power were a two-way instead of a one-way street -- or if each of us could galvanize the other people who felt the same way just by posting a notice on the right computer bulletin board."

But the Altair, the first commercially available microcomputer, was far more suited to the dedicated hobbyist than the ordinary citizen. Relying on toggle switches for input and blinking lights for output, it contained about enough memory for one paragraph of text. A great deal of skill was required to assemble and make any use of the machine. Still, when the Altair was featured in the January 1975 issue of "Popular Electronics," its tiny manufacturer was deluged with orders. In northern California, hobbyists who built these and similar machines banded together in the Homebrew Computer Club, an anarchic group with no official membership, no dues, a free newsletter, and a view that the new technology should be shared by all. This subculture of hobbyists who designed, built, bought, programmed, and popularized personal computers was by no means a political movement. Still, most of these young men (and most were white, middle-class men) shared a suspicion of large institutions -- IBM, the Pentagon, the University of California, etc. Some future microcomputer designers and entrepreneurs spent the 1960s and early 1970s organizing draft resistance (Fred Moore, founder of Homebrew); traveling in India seeking universal truth (Steve Jobs of Apple Computer); organizing free universities (Jim Warren of West Coast Computer Faire); protesting the Vietnam war (Mitch Kapor of Lotus Development Corp.); and assembling homebrew bullhorns for Stop the Draft Week, the mass assault on the Oakland induction center (Lee Felsenstein of Osborne Computers).

Wozniak and Jobs, who frequented Homebrew meetings, proved that microcomputers (also called micros, personal computers, and PC's) were more than a fad for high-tech wizards. After selling a Volkswagon bus to finance the design of their first printed circuit board, they filled orders for the first fifty Apple I computers by buying parts on 30-days credit. Their Apple II, introduced in 1977, could be used by schoolchildren, not just engineers. They also broke with the tradition of other computer manufacturers in publishing the technical details of the machine and encouraging "third-party" suppliers to produce accessories and programs. Apple quickly attracted a PR whiz to capture the public's imagination, and a former Intel executive to provide business acumen and attract venture capital. Their success is legendary. By 1982 their machine epitomized for the public the mystique and promise of high-tech, while their company had made it into the Fortune 500.

Why Early Microcomputer Makers Prospered

Apple and other early microcomputer makers were able to prosper because established electronics and computer firms moved slowly into the realm of micros. Wozniak's employer, the electronics giant Hewlett-Packard (H-P), rebuffed Wozniak's attempt to design a personal computer for H-P. As a result, H-P first entered the micro market in 1980. Xerox designed personal-sized computers in 1974 but, fearful of undercutting their other product lines, marketed them at big computer prices until 1981. IBM, which never lost its dominance in the big computer market, moved hesitantly into microcomputers. But by 1980, IBM's top brass could no longer ignore this sensational new segment of the market. Realizing that micros were different from the rest of its business, they went to former counterculture hacker Bill Gates for the IBM PC's conceptual design. Gates convinced IBM to use widely available standard components and publish the machine's design, following Apple's lead and defying its own tradition of secrecy.

The IBM PC was neither technologically advanced nor a great bargain, yet virtually from the moment of its introduction it dominated the market. Within a year of its introduction the IBM PC was outselling the Apple, and most firms whose machines could not use the thousands of programs and accessories developed for the IBM were wiped out. IBM's entry legitimized personal computers in the eyes of corporate managers heretofore skeptical of the need to supplement their large central computers. Fortune 500 companies and government agencies bought micros, usually IBM's, as individual work stations for their white-collar employees. Corporations rapidly supplanted individuals as the main purchasers of micros, forcing manufacturers to tailor PCs to business applications. Programmers who got their start bypassing Ma Bell's billing system and crashing corporate data banks were now creating automated accounting packages and billing systems. Meanwhile, the domination of IBM and the slowdown in computer sales in the mid-1980s drove many of the smaller (and more innovative) microcomputer makers out of business.

Computer for the Little Guy

Ironically, the corporate giants IBM and Apple vied to maintain the image of microcomputers as weapons for the little person. IBM ads evoked the image of Charlie Chaplin's little tramp, while Apple stunned Superbowl viewers in January 1984 with a commercial for its new Macintosh computer which showed a young woman evading riot police to smash a huge telescreen, and claimed that the Macintosh would keep the year 1984 from becoming Orwell's "1984." This million-dollar-a-minute anti-authoritarian appeal was a fitting metaphor for the tension between Apple's renegade past and establishment present, a tension further emphasized in the subsequent departure from Apple of founder Jobs in favor of the former head of marketing for Pepsi.

Vestiges of the Counterculture

While corporate dominance of the microcomputer industry has been thoroughly established, vestiges of its counterculture origins remain. Blue jeans, beards, and even women are acceptable in the labs and boardrooms of the younger companies. Apple -- admittedly with much less to lose than the old-line computer giants -- has halted all of its South African business in protest against apartheid. More important, in the thriving world of microcomputer devotees and hobbyists there is a still powerful counterculture, directly descended from the 1960s counterculture, that seeks to use computer technology to decentralize the control of information, question authority, and work for social change. For instance, Lee Felsenstein, once a peace activist and the master of ceremonies at Homebrew meetings and later the designer of the successful Osborne computer, remains active in Community Memory, a unique Berkeley experiment organized in the early 1970s to provide free public access to a computer information system and communications network.

The most hopeful progressive hackers continue to view microcomputers as liberating technology. They point to the potential for political participation and organization through networks of computers connected by phone lines; the ability of individuals and small groups to gain access to and manipulate data, do typesetting, and perform other tasks which previously required large and costly machines; and, perhaps most important, the demystification of computers themselves. The positive features have become a reality for many academics, professionals, and their children. However, the benefits of PCs are heavily concentrated among the privileged, and progressive hackers seem sometimes to confuse their own advantage with social progress for the masses.

Reinforcement of Inequalities

Rather than serving as a leveling force, microcomputers seem likely to reinforce inequalities in our society. By 1985 only 7 million homes had computers, and fewer than half of these could communicate with other machines via phone lines. As phone rates skyrocket to pay for the replacement of voice service by the digital network needed for sophisticated computer uses, the share of households with telephones may fall precipitously from the current 92 percent. Lifeline phone service may help the elderly poor stay in touch with their grandchildren, but it will not allow connect time to plug into Compuserve or MCI Mail. Poor and minority children from homes and schools lacking computer resources (not just machines, but trained teachers and programs) will be ill prepared for the "silicon future." Similarly, while women clerical workers are perhaps the predominant (alienated) computer users, girls and women are conspicuously rare among the recreational and professional users whose lives are enriched by computers. As the affluent begin to mail, bank, and use libraries "on line," traditional information services are likely to decline. The great mass of computer have-nots will be like the car-less urban poor who were trapped in decaying cities by the rise of the automobile and the abandonment of mass transit.

A Future for Hackers

But this portrait is perhaps too bleak. Microcomputers continue to pose new challenges to the smooth functioning of capitalism. Proprietary computer programs and data, unlike other commodities, can be easily copied and distributed. One need merely insert a floppy disk into a PC disk drive and instruct the machine to copy, a process which takes seconds and costs virtually nothing. Though illegal, such copying is almost impossible to detect and has become socially acceptable. While some program vendors use complex codes to make copying difficult, such schemes are rapidly circumvented by the thousands of computer hobbyists who consider each new copy-protection code an entertaining puzzle to be solved. Many of these code-breaking programs are widely available, and vast numbers of hackers maintain the cooperative and outlaw spirit of microcomputing's early days, freely exchanging licit and illicit copies of programs, breaking into Pentagon and corporate computers, and generally raising electronic hell.

Two decades ago campus radicals viewed computers as monsters: distant, impersonal, and threatening. They pleaded "I am a human being! Do not fold, spindle, or mutilate me!" The coming of the micro was accompanied by the computopian vision of social relations as a mere reflection of technology. But in political terms computers are like many other tools. The ruling classes have always had more, larger, and more sophisticated printing presses and weapons, but books and bullets were also the media of Marx and Mao. Today, left-wing computer literati put out newsletters, generate mailing lists, target precincts, edit this issue of "Monthly Review," and in other ways put microcomputers to progressive use. Others lend their skills to third world countries such as Nicaragua, which need data processing to strengthen their economies. And should the powers-that-be ever assemble a "Big Brother" computer system, we can hope that there will be plenty of hackers out there prepared to bring the system crashing down.

References

/1/ A "hacker" is an (often amateur) computer enthusiast, with intimate nuts-and-bolts knowledge of the machinery and programming.

/2/ A transistor, like a vacuum tube, switches or amplifies an electronic signal. The term "semiconductor" originally referred to the materials (e.g., silicon) used to make transistors, diodes, and other miniature electronic components. It has come to be used as a generic term for the components themselves. An integrated circuit (IC or chip) is a single piece of semiconductor material which includes more than one (as many as millions) of transistors. ICs allow complex electronic circuits to be embedded in a single, small, reliable, and cheap piece of silicon.

Ω

Glass Annealing and Artificial Intelligence

Cindy Griffin
Texas Instruments Co.
P.O. Box 2909
Austin, TX 78769

"The unique feature of this expert system is that it is based entirely on heuristics, reflecting the real-world experience of the expert ... No theoretical equations in thermodynamics are used ..."

Glass Manufacturing

A glass manufacturing company may produce a wide spectrum of things from glass: economical tumblers, glass crystal designed by master artists, high tech glassware, fiberoptic cable, television picture tubes, and so on. Corning Glass Co. and Texas Instruments (TI) set up a joint development program to determine whether artificial intelligence (AI) has the potential to improve the kinds of manufacturing processes Corning uses, and also to help Corning managers in other parts of the company evaluate AI technologies for possible application.

Corning Glass Co. and Texas Instruments established four factors to guide them in selecting the first test application of AI. These factors have become standard for choosing demonstration and test subjects for artificial intelligence. The test application would:

- be typical of Corning processes;
- be relatively easy to implement;
- offer measurable economic benefits;
- capture the expertise of experts near retirement.

They chose annealing -- specifically, the annealing of TV picture tubes at the Corning plant in State College, Pennsylvania.

Annealing

Virtually all glass objects must be annealed after they have been formed. The object of annealing is to relieve the stresses created when the molten glass is suddenly cooled by contact with the relatively cool mold. Without annealing, the glass may shatter any time it's bumped or heated or cooled. Even slight deviations from the ideal annealing times and temperatures can cause cracking. Often, such losses occur during the annealing run itself.

Annealing is done in furnaces called "lehrs." To minimize handling and conserve fuel, all the products, while still warm from one forming operation, flow through an adjacent lehr. The glass objects ride through the lehr on a steel mesh belt, at a speed fast enough to match or exceed the production capacity of the forming operation. The lehr for the TV funnel operation is 10' high and 180' long. Picture six boxcars connected end to end, and you'll have a rough idea of the size. Hot gas is generated just inside the input end of the lehr. It's guided down the length of the lehr through ducts below the conveyor. The temperature of the inlet gas stream is easy enough to control. What's tricky is to set about a dozen dampers, ports and louvers along the length of the furnace, to establish the precise temperature profile required. Different profiles are required for different masses, shapes and types of glass.

Trial and Error

In the past, trial-and-error methods were used. But a large lehr, because of the mass of fire brick that must be heated before temperatures stabilize, typically requires 12 hours before any change in a setting is reflected in the temperature profile. That meant 12 hours of lost production. And if the first trial was an error, another 12 hours or more until they got it right.

A few years ago, some Corning engineers had created a mathematical model of a lehr on a computer, based on thermodynamic principles. It worked well enough in theory, but it couldn't be translated into the actual settings of the dampers, ports and louvers that the operator had to use.

The team from Corning and TI decided that their first expert system would focus on diagnosing breakage problems that occurred at the lehr. In general, product defects caused by other processing steps manifest themselves when the glassware cools as it leaves the lehr. So diagnosing breakage would help isolate the upstream problem that required correction. In the course of working with the human expert on breakage diagnosis, however, it became clear to the team that the expert's special knowledge was how to adjust the lehr controls to perfect the temperature profile. The team completed the breakage diagnosis system, and then began to create a system that could be used for setting up a lehr to achieve a desired temperature profile along its length.

VAX computers were chosen for both the development and delivery systems because both Corning and TI had access to them. TI programmed the system in NIL Lisp, which was developed at MIT. For graphic output, Tektronix terminals were used.

Because process engineers were to be the end users, they were involved in reviewing the system from its early stages. "We always try to get end users deeply involved in creating the expert system," says Rick Herrod, TI's manager of Industrial AI Applications. "After all, they're the experts in the practicalities of the operation. They make many valuable contributions, both during the system's development, and in perfecting it once it's put to use on the shop floor."

Computer Model

The team first created a simulator, or computer model of the lehr. The simulator has provisions for varying the dozen control variables that produce the lehr's temperature profile. The computer program interrelates all the variables and displays the resulting temperature profile graph compared with the desired profile. The operator can change any of the control settings simply by placing the computer's cursor over that control on the display, and typing a different number for it. In the case of a damper control, for example, typing the number "1" closes the damper, typing "2," "3," or "4" indicates successively larger openings, and typing "5" sets the damper at full open -- reproducing the actual settings of the real damper, which is set manually.

The unique feature of this expert system is that it is based entirely on heuristics, reflecting the real-world experience of the expert, and his "rules of thumb." No theoretical equations in thermodynamics are used, "because furnaces don't read textbooks," as one practical wag put it.

Testimony to the accuracy of this heuristic approach was provided by sending a thermocouple through the lehr to create a profile of actual temperatures. It proved that the simulator's results were within the repeatability of the thermocouple's measurements.

Simulator

Because the simulator can react like the real furnace, only in seconds rather than in 12 hours, it's providing a secondary benefit as a training tool. A process engineer can sit at the keyboard, change the variables, and study the resulting temperature profiles. Months of experience is thereby condensed into a few hours.

Planner

The simulator, useful as it was, was only the first step. The second step was to create a planner, a system which, given the desired profile, varies the control settings according to rules laid down by the human expert to achieve the desired result.

In production, the process engineer uses the planner first when he is given an order to prepare the furnace for a change in the type of parts being annealed. As the first step, the planner asks for the three most critical points on the desired temperature curve: Hold Time, the time the glass must remain softened by holding it above the annealing temperature; Slow Cool Rate, the rate at which the glass is permitted to cool down to the temperature at which strains could begin to develop; and Exit Temperature, the temperature at which the glass can leave the lehr without danger of the sudden cooling causing stresses.

Once it has received these three desired characteristics, the planner runs the simulator until it displays the desired profile and all the furnace settings necessary to achieve it. After the system has determined the required settings, the operator can use the simulator to modify the temperature to meet other concerns. For example, if the peak temperature chosen might cause slumping of the softened glass in a particularly heavy part, the operator can use the simulator to

(please turn to page 25)

Newsletter – *Continued from page 3*

The most persuasive passages are to be found in the authors study of the long-term effects on health.

Even the most basic of clearing-up operations -- finding and burying the dead -- assumes terrifying proportions. A 10.35 megaton attack on London would result in 5.8 million deaths, over 90 per cent of the city's population.

In decimated Hamburg in the 1940s government authorities estimated that 10,000 bodies remained unrecovered even two years after the Allied bombings.

In the Philippines at the end of the Second World War, massive trenches, created by bulldozers, were used to bury almost 40,000 corpses. It took 80 men eight weeks to bury them.

Any who did survive a 10.35-megaton attack, even if they had stocked up with two weeks' food, could expect no prospect of furthur supplies. Daily deliveries of perishables in to the city would cease due to contamination, transport difficulties and human reluctance.

Non-perishable food such as dehydrated and canned food would already have been seized and impounded by the armed authorities acting under martial law. ....

In the worst scenario, the ambulance service would be obliterated in the centre of the city or be too far dispersed to be able to return to the centre through the rubble. And rubble would be a major obstacle on its own. ....

London's infrastructure, in a state of decay already, through neglect, would be further dislocated in the event of even a minor attack.

The 726,000 kilometres of water pipeline and 1280 kilometres of 19th-century sewer would become irreparable and a source of immediate danger to survivors through the spread of infection. At the same time most of London would begin to flood. ....

This report is specific, highly relevant and merciless. It is almost an Automobile Association handbook to London after an attack. The question is whether this report, like the handbook, will be stashed away in a glove compartment until it is needed to find our way around afterwards. Or used to find our way out before, instead?

ELECTRONIC COTTAGERS UNITE

Based on a report in the "Los Angeles Times"
Los Angeles, CA
August, 1986

Topping the eight-item list of The Electronic Cottage Bill of Rights is the statement: "Legislature shall make no laws prohibiting freedom of opportunity to work in one's home with a computing and/or robotic device when that work does not interfere with neighbors' enjoyment of their own homes and environment."

Says item 7, "Electronic cottagers shall be fairly treated by employers in terms of pay, benefits and conditions of work."

The Electronic Cottage Bill of Rights is the inspiration of Paul Edwards, who credits "generous help from our forefathers." Edwards is co-founder of the Assn. of Electronic Cottagers, an organization with 400 members based in Sierra Madre.

The 1½-year-old association serves the business needs of self-employed computer entrepreneurs and telecommuters who work at home on a salary.

"One of the things we wanted to do was establish a professional image for the person who works from home using a computer in their work or computer-based occupation or business," said Edwards, "so that they are on an equal footing to any other type of business for the purposes of insurance, loans, the ability to get Visa and MasterCard." A major goal of the organization is to promote the concept within the business community that the home is a respectable place in which to work, in which there are many benefits for everybody.

A monthly newsletter published by AEC keeps members familiar with issues affecting their interests, and there is an on-line bulletin board, electronic conferences and private databases available to members through CompuServe Information Service.

One of the issues covered is the AFL/CIO's opposition to telecommuting. AFL/CIO has asked the U.S. Labor Department for a ruling against doing computer work at home.

About 240,000 Americans are telecommuters, according to a recent survey conducted by Electronic Services Unlimited, a New York firm specializing in remote work, including telecommuting. The figure includes all peo-

(please turn to page 25)

Moiseyev – *Continued from page 12*

and American scientists have pointed up the need for a fundamental review of the starting principles of human relationships on the planet as well as of the ways and means of resolving conflict situations.

The Extreme Urgency That Exists

It is a matter of extreme urgency to unite the efforts of scientists conscious of the need to look for alternative ways of drawing up and carrying out a wide-ranging public-education program. Success can occur only if the scientists of all nations join forces to prevent a nuclear and ecological disaster and if their research findings reach billions of people, that is, everyone whose future is at stake today.

When I speak of pooling the efforts of scientists, I do not mean only the mathematicians, geophysicists, biologists and natural scientists. Our colleagues the humanists have a tremendous part to play. Natural scientists are in a position to formulate those restrictions that nature is imposing on human activity, that is, to find the "danger line," to construct cooperative agreements in ecology, to identify the arms limitations needed, and so forth.

Humanist Institutions of Concord

Only by acting together can people enforce all these bans and restrictions. In this area humanists must take the initiative, urging that spontaneous resolutions of contradictions give way to the quiet wisdom of the "institutions of concord" and explaining to people that the world is now entirely different from the beginning or even the middle of this century. Humanity is on the threshold of a noosphere, an epoch that requires a new kind of morality and ethics.

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Newsletter – *Continued from page 24*

ple who have a computer at home and work for a company, and includes those who may only work at home one day a week, and are at an office the other days. The number of telecommuters who work at home full-time is lower, about 10,000, Edwards said.

The outlook for telecommuting is "that the growth will be gradual, but slow until there is something that will spur it on, such as encouragement from government, which is happening here in Southern California in the beginning phases," said Edwards.

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Nievergelt – *Continued from page 17*

A "Do-It-Yourself" Medium

We believe, however, that the computer-driven screen has a much greater potential than merely that of an emerging mass medium. It is also a "do-it-yourself medium," to be used in place of a chalkboard, flip chart, or overhead projector by anybody willing to acquire some programming skill. We have often wheeled a microcomputer and projector into a classroom to demonstrate through graphic animation some process that could not have been shown by any other means. For example, uses of random numbers, traversals of data structures, and simulations of physical systems. The programs that generate these animations were only slightly more complex than standard textbook examples. With experience, a library of previously written dialog programs, and a good set of programming tools, a teacher can produce demonstrations as a side effect of class preparation.

Much remains to be learned about our most recent educational medium, but we predict that in its mode of use it will be closer to the chalk than to the audiovisual materials which were the fad of the past decade. Teachers, students, and hobbyists will be the major producers, not companies or teams of professionals. And many of us will turn away from being mere spectators and find pride in creative tinkering. Ω

Griffin – *Continued from page 23*

lower the temperature to a point just above the annealing temperature.

In Practical Use Now

The planner and simulator are now at work on the shop floor at Corning. The project has demonstrated that it's possible to build an analytical model of a manufacturing process based solely on the knowledge of an expert engineer. In this case, the model was based on the engineer's intuitive feelings for heat transfer rates and how the control variables interact in the annealing furnace itself. Thus, the system has captured some of the expertise of a valuable human expert who is nearing retirement age.

At the same time, the lehr operators have been given a tool to help them change furnace controls for different products without creating process upsets that can eat into profits. And the process engineers, freed from frequent calls to meet annealing crises, have more time to concentrate on making long-term improvements.

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Newsletter — *Continued from page 25*

The Southern California Assn. of Governments calls for a 12% reduction in work-related trips by the year 2000 as a means of lessening traffic congestion and air pollution. At least one-fifth of a projected 15 million workers in Southern California could be telecommuters by the year 2000, according to Pat Mokhtarian, senior telecommuting planner for SCAG.

The association, which represents six counties, currently employs 18 workers -- 15% of its staff -- as telecommuters under a new pilot program. The home-based employees, on the average, telecommute only one day a week in the program. Costs are minimized because computers and special hardware are not purchased for employees.

SCAG plans to establish pilot programs with companies in the area. "We're a long way from confirming our long-term goals, but we're taking steps toward getting there," said Mokhtarian. Ω

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THE GRITTY INTERFACE
between the Real World and Information Systems

– PORTION –

Vol. 1, No. 2 Serial 2 November, 1986

ANNOUNCEMENTS

by Edmund C. Berkeley

Issue No. 1, August 1986, was sent out to all subscribers of "Computers and People" in August. If you did not receive your copy, please write us and ask for it.

Here is a portion of Issue No. 2. If you would like more of Issue No. 2, please ask us. The first two issues of "The Gritty Interface" are free to subscribers of "Computers and People". The main articles in Issue No. 1 are:

- Computers, Math, and Elementary School, by John Saxon
- Teacher's Comments by Computer, by Dale Koppel, et al.
- The Ford Motor Co. and Old Joe, by Neil Macdonald

We hope our subscribers to "Computers and People" will also subscribe to "The Gritty Interface."

PROGRAM TRANSLATIONS BY DJINNI

by Edmund C. Berkeley

How do we (people in the computer field) overcome the exasperating grit of (1) having a good progra ... langu-
age, and (2) tran ...
another programmi ...

Here is a very ...
within the comput ...

We would of co ...
by computer. And ...

We (Berkeley ...
that we have don ... s
which we call th ...
lieve we know ho ... -
nary computer pr ... ny
programming lang ... ort"
I mean 2000 instruction ... y
"ordinary" I mean a sequential program where each command or instruction changes a variable (which we may call F of x) to the next value of F (which is F of x plus one), usually. But the next value of F may involve two values, one if a certain truth value T is 1 and another if the truth value T is 0. Etc.

Now, obviously, a computer program sometimes has to behave like a simple idiot, as in checking an indicator or flag 2000 times (or thereabouts), as in loading a buffer to see when the buffer is completely loaded. But it is easy to put into the translating computer program (which we call DJINNI) a subroutine for the elimination of excessive repetition.

We worked much on the DJINNI concept from 1971 to 1981, and invested more than $100,000. But we never were able to "take off" in the venture sense. So we have avoided at least 200 headaches and heartaches.

DJINNI stayed dormant from 1981 to 1986 (I was sick with shingles, hepatitis, and other illnesses).

Now we place DJINNI in the free public domain. For more information, please write us.

FINDING STREETS AND HOUSE NUMBERS

by Neil Macdonald

I was driving in Brookline, MA, on a day in September, trying to find the local office of the Hoover Cleaner Co. of Ohio, at 448 Harvard St. in Brookline. I was closer than a mile to it, and yet it required 3/4 of an hour of hunting and two consultations at two gas stations to find it. Here were the obstacles:

- There were not more than 3 house numbers in approximately 20 blocks, or some 200 shops.
- There were more than 1000 signs and messages on shop windows, all of them advertising, not one of them telling the house number.
- The regular stupid procedure in Massachusetts is to put only one street sign at a crossing of two streets. The reasoning for that is just plain Yankee arrogance.

It would be so simple for the aldermen in Brookline to enforce house numbers on every house, and two street signs at every intersection.

FORBES MAGAZINE: REPRINTS

by Edmund C. Berkeley

In September I walked into the offices of Forbes Magazine at 60 Fifth Ave., New York, and asked to see the list of reprints from Forbes magazine that Forbes had issued from 1979 to 1986, to see if I wanted to buy or read any of them. Only guards with pistols

(continued on page 2)

For pages 2, 3, and 4 of this issue of "The Gritty Interface," see the complete issue, available from Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160.

Opportunities for Information Systems

– Instalment 6

READING FOR FUN

Edmund C. Berkeley, Editor

One of the most desirable and even necessary abilities for every human being born and growing up to adulthood is the capacity to read and read easily and read for fun. He should read his own language and at least one other language that has international use. How can a parent know whether his or her kid is reading well?

The teacher often says "Johnny is behind his grade level in reading but not much, and he and I are working on that problem." Who knows besides a teacher what grade level is? and whether the grade level has sunk and sunk over the last 30 years so far, that 20% of adults in this country cannot read a job application or a sign on the streets – although they have "graduated" from high school?

The statement by the teacher cannot be understood by a parent because of the phrases "grade level" and "working on". It conceals bad work in terms of low requirements and sirupy damping of protest.

Now, suppose you find your kid sitting on the sofa after supper, reading for fun any good book like "Treasure Island" or "The Arabian Nights Entertainment" or "The Water Babies" or "The Tale of Two Cities", and s/he is entranced and excited, and your kid is 8½ years old. Then the world of books has become open to him/her. If you want to verify, ask s/he to read a paragraph out loud (because you would like to know what is so exciting). Then you confirm that the kid reads well and pronounces well, and so the goal of Johnny reading well has been attained. The "Pentagon" of remedial reading education with its doctors of education goes out of business.

Your own very simple information system of watching and noticing (at the right time, about age 8 and ½) tells you that success has been attained.

In the same way, the reciting of the alphabet A, B, C, D, E, F, G, H, at high speed, down to Y, Z shows objectively, clearly, observably, that the kid has mastered a solid and real (not "teacher-says" style) achievement – the knowledge of the alphabet.

We are designing and working on machines for information systems that produce these results: good reading; good knowledge. The market should be in the billions of dollars all over the world in 1700 languages for 5 billion people. The machines will be cheap, cheap, cheap. For details, write to Berkeley Enterprises, Inc., R11. Ω

Games and Puzzles for Nimble Minds and Computers

Neil Macdonald
Assistant Editor

NUMBLE

A "numble" is an arithmetical problem in which: digits have been replaced by capital letters; and there are two messages, one which can be read right away, and a second one in the digit cipher. The problem is to solve for the digits. Each capital letter in the arithmetical problem stands for just one digit 0 to 9. A digit may be represented by more than one letter. The second message, expressed in numerical digits, is to be translated using the same key, and possibly puns or other simple tricks.

NUMBLE 8611

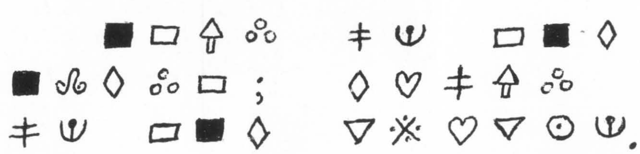
```
        T H E R E
    *       A R E
    -------------
      O G E O O G
    H A S T O O
  E C O D T A
  ---------------
= E T D D A R C G
```

91182 18XY6 43035

MAXIMDIDGE

In this kind of puzzle, a maxim (common saying, proverb, some good advice, etc.) using 14 or fewer different letters is enciphered (using a simple substitution cipher) into the 10 decimal digits or equivalent signs, plus a few more signs. The spaces between words are kept. Puns or other simple tricks (like KS for X) may be used.

MAXIMDIDGE 8611



SOLUTIONS

MAXIMDIDGE 8609: What is not often seen is soon forgot.

NUMBLE 8609: Habit has an iron shirt.

Our thanks to the following person for sending us solutions: Leon Davidson, White Plains, NY – Maximdidge 8609. Ω

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