LETTERS TO THE EDITOR

AI'S IMPACT ON EMPLOYMENT

Editor:

Thank you for the excellent intention and effort in presenting Nils Nilsson's article on the long-term socioeconomic aspects of increasing application of artificial intelligence. Please let me offer some thoughts on the spread of technology to the third world.

In the article, James Albus is quoted with agreement in saying that military conflict is inevitable if the current population explosion is not matched by a corresponding increase in affluence based on improved industrial productivity. The expansion of affluence suggested to avoid more human tragedy is certainly urgent. But it is critical that control of the sources and types of affluence are local to the areas affected. To illustrate by sad counterexample: the citizens of Nicaragua and El Salvador will watch passively an upcoming U.S. election which will have a much more profound effect on their lives than on those of citizens of Nebraska or Alabama.

Artificial intelligence might have a positive effect if the current trends in AI and related hardware lead to worldwide democratization of access to information and expertise. For the third world, this might enhance both the growth of affluence and maintenance of local control.

As an example of growth of affluence (*i.e.*, well being), there may be relatively few doctors with specialist training in diseases of the uterus in Kenya, a nation where women have an average of nearly ten children. Availability of sophisticated, inexpensive uterine disease expertise could ameliorate much suffering. This availability is within current technological capabilities, and is far less costly than sending a number of Kenyan doctors abroad for special training. So this is one form of international democratization of information.

As for maintenance (or enhancement) of local control, increasingly natural human/machine interfaces might contribute to the adaption of "external" technology to local needs. The Kenyan medical community might be able to adapt a uterine disease expert system to include knowledge of local customs and cures The enriching use of outside resources should not require thralldom to the originators of those resources.

It is hard to imagine that spread and democratization of access to information and expertise (facilitated by AI technology) to be smooth or painless. Let me tentatively suggest an historical analogy. The decline of the control of the Catholic Church on the secular affairs of Europe was concurrent with the emancipation of literacy from the control of the monasteries. If AI can provide the broad access to science currently denied to the vast majority of the world's population, then it may be a new kind of literacy. As the effects of spreading literacy were unforseen in thirteenth century Europe, so it is difficult to anticipate what effects will ensue from "universal scientific literacy" (if the suggested analogy has any merit.) Still, the changes suggested by this analogy, and by parts of Dr. Nilsson's article, are not likely to occur without a revolution comparable to that of the Renaissance.

Jim Kornell
General Research Corp.
Santa Barbara, CA

Editor:

I asked several friends who are not into computers what they thought of Nils Nilsson's statement in "Artificial Intelligence, Employment and Income": "Many AI scientists believe that artificial intelligence inevitably will equal and surpass human mental abilities—if not in twenty years, then surely in fifty."

A typical response was, "They've been watching too much television." I'm afraid ordinary people have more common sense about the potential for intelligence machines than researchers who are wrapped up in their work.

The day is far off, and probably will never come, when a machine can do what every human above the age of five has done effortlessly: master a language just by listening to it and observing what is going on. And I doubt that machines will be able to do original AI research either

Robert Park
Fairborn, OH

Editor:

The critical reader will have noted that Nils J. Nilsson's basic premises seem to be threefold: there exists a level of consumer goods and services which, if provided to each person on the planet, will mitigate all envy and dissatisfaction, revolution and despair; AI will provide this surfeit of goods; and our biggest problem, in that millennium, will be unemployment ("Artificial Intelligence, Employment and Income," Summer 1984, p. 5).

Three caveats must be made in response to this simplistic world view. First, unless application of AI increases significantly the rate of yield per input unit from our ever scarcer mineral resources, Nilsson fails to anticipate both the depletion of these resources and the more rapid build up of pollutants in air and water which are predictability the concomitants of increased productivity. Granted, large scale use of such AI tools as Prospector, if effective, might help somewhat to boost our exploitable base of minerals. Let us not, however, be Pollyannas and assume that AI will free us from the most deadly consequence of our unbounded greed for ever more goods—contamination of our planet.

Second, it is difficult to see how the lesser developed countries (LDC) will be benefitted by AI if it is not delivered to them in the form of capital and technological know-how. And, despite ever increasing productivity, "spill-over" from the developed countries has not seemed to lessen appreciably in the last one hundred years the poverty, despair, and constant revolution which Nilsson rails about. In matter of fact, several of the LDC seem more interested in the technology of weaponry than in productivity increases. (These LDC may still be served by AI, however, since pattern recognition technology is having its quickest application in target identification.)

Finally—perhaps in a lighter vein—consider for a moment this prospect of displacement of huge numbers of workers by AI technology, Pernicious effects will more likely appear not among those so fortunate as to be liberated by AI, as Nilsson seems to think, but among those doomed to continue working while surrounded by legends of the formerly employed who now spend their time in activities "more gratifying and humane" (in Nilsson's words). Won't those left behind to work—whether in the caring professions, sport, craft, and entertainment or in the tasks of designing, overseeing, and maintaining AI technology—display the same symptoms of surly dissatisfaction as are now seen among the unemployed. Alternatively, a cynical reader may wonder how gratifying and humane will be our leisure time activities if greater blocks of time are made available to us through AI or any other technology. Consider the predictors: Watching TV and going shopping are clearly now the major cultural activities in the United States. (We now spend an average of 7 hours a day watching TV.) There is nothing wrong with this, I suppose, but let's not expect AI to have much effect except to provide more time.

In reality, articles such as Nilsson's prime an already greasy pump, boosting the enthusiasm and *esprit-de-corps* of AI workers, of which I am proud to belong, but they do little to convince the public that we have a balanced perspective. Do we really believe that the worlds most pressing needs are for more goods with less toil?

Prof. Christopher Dungan
University of South Florida

Editor:

It was extremely stimulating to see that the subject of the impact of the developments in Artificial Intelligence was brought to the attention of a larger public by Nils Nilsson (SRI) first at the International Joint Conference in Karlsruhe in August 1983 and then again, more extensively, in an article in *AI Magazine*. It is important that he, as an American, is calling attention to this problem. The reason to stress the fact that Nilsson is writing on this subject as an American comes from the conviction that our thinking about economic problems is also framed within our national background. Consequently, although I agree with many of Nilsson's points, my perspective on them is different.

The position of The Netherlands differs in several respects from that of the United States . And it seems to me that the view Nilsson is promoting is enhanced by the size and richness of his country, the United States and perhaps even more by its actual political and economic policy. Living in that country, one finds it difficult to escape the temptation to think that the world's interests coincide with those of the United States—an impression that is corroborated by the omnipotence of the economic-military power that the United States can impose on much of the outside world. Moreover, the United States has a rapidly growing population (10% in 1983, to a large extent due to immigration), which means that even to maintain the living standard, the production of goods, houses, and cars has to rise 10%. In addition, military spending has quite some impact. Caused by all this, or on top of all this, the United States economy is booming.

Although I disagree with Nilsson's strong hypothesis about AI technology reaching the stage of complete competition with human capabilities, I think he is right in suggesting that the consequences of this and other high technologies will cause an enormous unemployment problem and that the social-psychological impact will be huge. The main impact will be due to the ever-increasing efficiency of our industries. First, the physical space to put all our products will simply become more difficult to find. But there will also be a psychological saturation: people have more things than time to enjoy them.

When our production efficiency increases much more quickly than the resources or our needs, then the productive labor to supply all needed goods will require a decreasing number of people So there will be fewer hours of productive labor per person in the years to come. Where will this lead to? Fewer working people and a growing number of unemployed with no guaranteed income, or fewer hours to work for everybody, and less money to spend? What can be done with the surplus labor force? The need to think about this fundamental problem is less apparent in the United States because of its booming economy, which obscures the existing trends and makes them difficult to recognize—making efforts like Nilsson's article even more important.

Nilsson stipulates several solutions to this huge problem. Although each suggestion has its rationale, so far none of them has proved to be the final answer. One of the first is to close the market for imports. This, however, is a short-term solution that shifts the real problems onto other people and to a later period in time, because it does not stop the efficiency to grow nor does it enhance infinitely the need for products. It only could make sense when the closing of the frontiers happens for a short time to give the industry involved the opportunity to improve its industrial efficiency. Otherwise, it only enhances the uncompetitiveness of one's own industry.

Another method to reduce the effects will be to slow down the pace of the technical developments and thus the speed with which people will be laid off. Can that be done and by whom? From industrial history one is inclined to

draw the conclusion that no government, but only the economic reality can bring such things about. Of course, there are means at the disposal of the government to speed up or to slow down certain developments by subsidizing directly or indirectly by taxation and the imposition of regulations. But, like the closing of the frontiers to imports, such indirect measures are dangerous weapons because they might not only promote a slowing down of its introduction and so of the lay-off of people, but they will also mean a diminishing inclination for the industry involved to modernize and so an increased danger of a loss of competitiveness. And that might in the end result in even higher unemployment.

A shorter work week is much emphasized, in particular in several European countries. Then, however, the real problems start. The increased productivity seems to make better payment feasible. If the productivity rises more than the costs of capital investments needed for this increase and the increased labor costs together, then it can be done with raising the price of the product. But this reasoning in only valid, when there is no competition or when all the competitors follow the same strategy.

The central problem—as Nilsson also stresses—is the distribution of income. This becomes even more apparent if one refuses the alternative of a shorter week. That means a decreasing amount of working people, which leads to speculation about the right of everybody to a reasonable, basic income. But this discussion decouples work and income, one of the topics Nilsson also mentions, which in itself is a counter movement to the actions of women to find their place in the labor market. The decoupling, however, has also the effect that for a lot of people the motivation to work disappears with the result that much work is done sloppily. Second, the burden of not-working but well-paid people creates a rapidly growing deficit for the government. To cope with that deficit and to prevent from going bankrupt, the government has to reduce its budget, which means in effect that it has to lay off its own employees and so reduce the level of service. A third problem is that a government that slowly becomes everybody's employer becomes more and more a gigantic bureacracy and an enormous financial power.

The last solution is that it is the task of the government to create new types of jobs. But where does the government get the money to pay for them? It is an illusion to think that the owners of fully automated factories will be willing to keep the governmental system going. They will leave the country for better tax paradises.

How can a country prepare itself? Nilsson is suggesting a kind of social think tank. I don't expect that these institutions have much effect on what is going on in the political-economic reality and in the mind of people. Perhaps my negative attitude comes from the frequent thinking-in-vacuo of such institutions. In any case, I am really doubtful that a single country can prepare itself for this development. In our days the economies are already so much interrelated that solutions are only possible by mutual agreement, not to say in a common effort For that reason I don't think there can be any social stability inside a country without one in the world as a whole.

I hope that it is clear from my remarks that I don't think Nilsson is suggesting the appropriate solutions, however attractive they might seem to be at face value. Both Nilsson's optimistic answer and the negative one do not take the political-economic reality seriously enough; they both describe an artificial reality. The big merit of Nilsson's exposé is that he draws attention to very serious facts about which our societies have to make up their minds. For it is not at all obvious that the developments—left alone—will give us a rehumanized society. The industrial development so far gives us enough to think about.

Joop Schopman
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Editor:

Nils Nilsson's article, "Artificial Intelligence, Employment and Income" (Summer 1984), strikes me as another example of the sheer power of fantasy that many otherwise scientific AI researchers are capable of when requesting funding or seeking other justification of their work. We are to believe that there will be no real excuse for work in another 50 years of automation. Yet, after 50 years of great progress in automation since the last reduction in the average work week many more people are employed than were in the 1930s. At the same time we have seen and we will see dislocation after dislocation, personal tragedy after personal tragedy, of those displaced by automation. If all were right in the world, progress in technology need not mean misery Our economic system is not only one of justice, compassion and democracy, but also one of power, greed and authoritarianism. How many times has there been a vote at a factory whether or not to automate? The truth that Nils Nilsson avoids is that both employment and unemployment will go on. This may be pleasant for computer scientists, but not very solacing to displaced auto workers.

Technical solutions solve only technical problems. For example, the scientific miracles of the Green Revolution have not eliminated hunger and possibly may have increased it. The technology already exists to feed every person alive, yet about one-quarter of the earth's population is malnourished or undernourished. The problems of humankind are social, not technical. How can a society that has destroyed the culture and economy of Polynesia and many other Pacific peoples expect that computers will bring to us a similar culture to the one we destroyed? Will a few shares of IBM stock make up for the loss of a skilled union job for a job at minimum wage?

So why the fantasies of Mr Nilsson? We must recognize that the philosophy of technical progress is a blinding and

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conservative one. To the well off and the powerful it is a justification of their sucess. To those less fortunate it is a false promise of a future. Such a philosophy is tempting to our profession that is intimately married to both technology and those with the economic power to fund research. Still we must demand of ourselves and our colleagues that our work make this world a better place not only for those with economic power, but to all people.

David Drager
University of Pennsylvania

NILSSON RESPONDS

Editor:

Thank you for the opportunity to reply to letters concerning my article.

I heartily agree with everything Mr. Kornell says

Mr. Park and his friends are entitled to their opinions about the ultimate limits of AI. He doesn't say whether his conservative view stems from thinking that the technical problems are just too difficult or from some sort of vitalist outlook. In any case, I wouldn't want to bet on either of those "barriers" holding.

Of the three basic premises attributed to me by Professor Dungan, I subscribe only to a rephrased version of the second, namely that AI (and other technologies) will ultimately be able to provide, without much human assistance, whatever level of goods and services we decide we need. Envy and dissatisfaction will no doubt remain--maybe even increase--with increasing goods and services. As for unemployment, I don't see it as a problem in itself, rather I see income distribution and rewarding use of time as problems. If these latter could be solved, I think unemployment would be welcomed. I agree that resource depletion and environmental contamination by a world population whose growth is out of control are problems fully as serious as the ones I mentioned. As regards leisure time, we might not all choose activities that everyone would regard as fulfilling. Some might choose to watch TV, some might choose to write (and reply to) letters to the editor. In any case, I would want to be careful about telling someone how s/he ought to use time. Lastly, I certainly do not believe that the world's most pressing need is for more goods with less toil; but I wasn't writing an article about the world's most pressing needs. I was simply trying to point out that developments in AI will lead to unemployment and that that wasn't necessarily bad in itself.

Although Professor Schopman says that he doesn't think I am "suggesting the appropriate solutions." he seems not to suggest any.

Mr. Drager and I might not be as far apart as he seems to think; I'd like to talk to him more about all of this provided he can first bring himself to believe that my "fantasy" has nothing whatsoever to do with "requesting funding" or "seeking other justification" of AI work. Much of his argument seems to be with those who are so taken by technology that they fail to see that many improvements in the human condition can be achieved only by changes in behavior and attitude. But, let's be content to put technology in its proper perspective without limiting in any way its potential to help us. He says that "if all were right in the world, progress in technology need not mean misery." Technology need not mean misery in any case—nor need it mean happiness. I'm only claiming that it is likely to mean unemployment. Does Drager really think that factory workers would vote not to automate if the choices were expanded to include:

(a) automate and lose your dull job and your income,
(b) don't automate and keep your dull job and your income, and
(c) automate and use the increased productivity to provide an income decoupled from toil and use the increased leisure time for more humanly rewarding activities?

Limiting the choices to (a) and (b) results in a rigged election, which workers ought not to tolerate! Technologists can be credited (or blamed) for only half of options (a) and (c); all of us must work together to create the nontechnical, the socioeconomic, half of option (c). Surely we can be allowed to hope that the self-serving uses of technology by the rich and powerful can be mitigated without abolishing technology and denying it also to the rest of us.

Nils J. Nilsson
Senior Staff Scientist
SRI International

A SPLIT CONFERENCE?

Editor:

Like most participants at this summer's AAAI convention, I enjoyed myself and felt my time was very well spent; I especially liked the wide mix of participants. Accordingly, I was dismayed at the occasional suggestion that our group be split, with "research" and "applications" going their separate ways. This strikes me as a mistake in a discipline as young and promising as AI. In any case, I've written a short report on the convention, but tried to do so by harking back to a fictitious convention in the 17th century—this in the hope of gaining perspective on what's going on now in AI

I hope that you'll find the report suitable for AI Magazine. Thanks for your consideration.

Marty Kalin
De Paul University
Chicago, IL

Report From The Annual (AAAI?) Convention:

Time: August 5-10, 1632

Place: Florence

Occasion: Annual Meeting of the Copernicus Association

At times, the convention seemed to generate more heat than light. In attendance were Galileo himself, representatives from the Medicis, a few staff from the Tuscan ambassador, hucksters, military officers, merchants, astrologers, inquisitors, astronomers of every stripe, gate-crashers, sailors, philosophers, jesters, and a few scribes Politics almost drowned out the usual talk about sunspots, newly discovered stars, the role of mathematics in physics, commercial and military applications of the telescope, and so forth. At issue politically was whether the Association should be split into separate groups, or even disbanded altogether; the membership has divided itself into two fuzzy sets, and each has pinned a derogatory label on the other The "gazers," as opposed to the "grubbers," are a theoretical bunch, some of whom expressed regret that the telescope had been invented in the first place

"Sure, it's opened some new areas of research," complained one famous gazer, "but most of the people here don't understand that it's only a tool. Just because some uppity student discovers a new star doesn't make him a mathematical physicist Of course, the students aren't as bad as all those former alchemists and theologians trying to pass themselves off as physicists."

He scowled extra hard for my benefit, I felt; then he went on, more heated than before: "Will you look at how the merchants and soldiers fawn over those applied types! Do you think they care about developing a theory to combat all that Ptolemaic nonsense? No, it's all quick fame and fortune by showing off your pyrotechnics Mark my word: the military and commercial people will be sorely disappointed in the end, and withdraw the funds from all of us. I see us sinking back into the dark ages! Ah, for the days when you had to please only an aristocratic patron, some Medici or other."

He paused to shake his head sadly, before continuing: "Maybe the Aristotelians were right after all—let's keep *theoria* absolutely distinct from *techne*. Let Tycho's disciples do the empirical work, and let us get back to the pure thinking "

The "grubbers," too, seemed uneasy with the convention, but also pleased with all the attention they were getting Many were showing off improvements to the new technology, or suggesting applications. Wherever they went, a crowd of merchant and military types was sure to follow Nonetheless, they had their own axes to grind:

"Look," said one of the grubbers, as he put his arm around my shoulder, "all we hear are papers about mountains on the moon, new satellites around Jupiter, the role of mathematics in astronomy, and the rest of it And these guys call it science! I haven't heard two papers that fit together, much less say anything useful. You'd think the gazers own the telescope, by Jove. Where do they get off saying we shouldn't exploit its possibilities?"

Before I could answer, he started again: "Now don't get me wrong—Galileo's a great guy, and I wish him well in Rome But some of his supporters have their noses in the air even when they're not gazing piously at the heavens "

He paused for a quick breath, and continued as if anticipating my question: "Yeah, we take money from merchants, princes, whoever. Who do you think is going to pay for better lenses so the so-called scientists can carry on with their silly speculations?"

I heard point and counterpoint throughout the convention, even after Galileo spoke. In the keynote address, he tried to reconcile the factions, but without much success. He reminded the attendees that battle against the Aristotelians was far from over, and called for unity in trying to free physics from the old philosophy: "Physics is really a brand-new discipline, and so not yet a science; we haven't begun to uncover the laws that extend from the earth throughout the heavens. But we're moving in the right direction, though the steps seem too small and slow to the impatient. What we need right now is a unity. The more popular the telescope, the more proficient its users—the better for all of us, both fledgling scientists and technicians!"

Neither side applauded with enthusiasm, as each took Galileo to be favoring the other. Only the papal astronomers seemed happy. As one confided to me over wine: "Why all the fuss about the telescope? It's of no use in science—we already know, from ancient authority, the number and position of all the planets. And these merchants, who are they kidding? I haven't seen one tell his sea captains to stop navigating by the old charts "

When asked about rumors that Galileo was about to be summoned to Rome, he smiled reasuringly: "Oh, we might call him in for a scare; you know, just give him a tour of the facilities. After I report about this convention, though, nobody in the Inquisition will be too worried."

Editor:

At the AAAI business meeting in Austin on 8/9/84, a main topic of discussion was the incredible growth in numbers at AAAI-84. Over 3,000 attended and another 1,000 were turned away. UCLA can accommodate over 5,000 people for IJCAI-85, but it is likely that even more than that will journey to Southern California. Unless something is done differently, AAAI-86 will have to be in Las Vegas or the Anaheim Convention Center.

Research papers do not draw the multitudes from government and industry. The attractive areas are the tutorials, the R&D exhibit, and Technology Transfer topics. These topics have substantial value to the "new" AAAI membership (myself included), but they have little to do with the major purpose of the annual national conference: the sharing of original research and development efforts by AAAI members. If the tutorials, the R&D Exhibit, and Technology Transfer topics were separated from AAAI-86, reasonable numbers of AAAI members would attend and benefit from a more focused conference. Perhaps a separate week at another time and place could be devoted to these non-research activities. Perhaps AAAI really isn't interested in orchestrating such a watered-down event.

John Gavin
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RESPONSE TO McCARTHY

Editor:

At the end of his Presidential Message in your Fall 1984 issue, John McCarthy, discussing the Turing test, states that "the ability to imitate a human must stand up under challenge from a person advised by someone who knows how the program works." But if this requirement be added many (intelligent) human beings would also flunk the test. For

instance, I know somebody quite competent in the field of computer science who consistently failed to grasp clearly the idea of hash coding; a Turing-tester who had been "advised" of this could formulate questions which might elicit responses inappropriate to a human computer scientist. More generally, a program—whether in a computer or a human being—must contain representations of knowledge and rules of manipulation of knowledge, and any gaps, defects or limitations in either of these (which always exist)—if known—can always be exploited by the Turing-tester to yield inappropriate responses.

Bernard Meltzer
Ispra, Italy

GOING PUBLIC

Editor:

As a member of AAAI, I would like to set forth a proposal that may have a profound effect on the way that Artificial Intelligence is used, and researched.

Presently, Artificial Intelligence, despite its recent growth rate, is the domain of a relative few. The potential for AI, however, is rather large.

I am proposing that AI go public on a much larger scale than it has previously; I am proposing that college level courses be taught on either cable or public television Previously, television has covered AI as one-time installments on the science special interest series, NOVA, which was aired on the Public Broadcasting Service.

There is a large and growing number of people who own microcomputers, and there is a growing number of systems which have either a 16 bit or a 32 bit bus and architecture. While 8 bits still constitutes the majority of microcomputer systems, they are slowly giving way to faster and better systems. Despite today's systems, there are at last count, four subsets of Lisp for 8 bit systems.

I believe that lessons in Lisp, Prolog, and AI should be made available to anyone who wishes to learn. While not everyone would comprehend AI, many would. The impetus from this would stimulate the sales of AI and AI-related books, add a larger pool of minds to the AI pool, and would tend to remove the cloud of mystery that presently surrounds Artificial Intelligence.

I believe that tomorrow's McCarthys, Feigenbaums, Winstons, *etc.* are out there

Mr. Robert L. Salmansohn
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COMPUTERLESS EXPERT SYSTEMS

Editor:

I read with great interest Jon Doyle's techniques and methodology paper, "Expert Systems Without Computers or..." in the Summer 1984 issue of the AI Magazine.

An "expert" knowledge-based system feasibility study was initiated by DARPA in the late 1950s under U S Army contractual control. However, at the time neither DARPA nor the design team identified the project in terms such as expert system or knowledge-based system. The study led to design, development, and extensive test and evaluation of such a noncomputer based expert system as Mr. Doyle now proposes. The implemented system was a success. A brief personally-recalled history, expunged for national security reasons, follows.

The original study, called by its acronym MODAPS, was conducted in the late 1950s, early 1960s and indicated potential productivity and maintenance quality improvements were possible using an exportable expert-knowledge-based system (not called such at the time, of course). Such a system would include maintenance strategies and techniques and data about its subject hardware and software subsystems. Design and development of A-VIS (audio-visual information system) was next undertaken to examine and test hypothesis of the study and prove feasibility through cost/performance comparison studies. This effort continued for some time, with small studies leading ultimately to a large scale test and evaluation of A-VIS in the early 1960s, under U.S. Army Test and Evaluation Command cognizance. Astonishing productivity/quality results were obtained and further work along these lines continued and does to this day (More study and test reports are available.) At the same time, the higher-degree of front-end analysis associated with such design led to an offshoot effort at improving the maintainability characteristics of machines through built-in maintenance and diagnostics (M&D) equipment and software. This effort was also successful and well reported, lending to today's "smart" machines. It seems that the bulk of present highly publicized expert systems efforts are aimed more at extending internal M&D outward from the machine system "core" than at dealing with human problem-solving techniques and augmenting human performance as the A-VIS and follow-on efforts have done. It is at this man-machine interface that the most difficult problems in system analysis and design occur Along this line of reasoning lies great support for Mr. Doyle's approach. From a cost/benefit viewpoint, today's complex systems have much higher costs for their operations and maintenance ("personnel subsystems") than for the operational hardware/software elements of these systems. Ergo, improved system cost/performance ratios can best be obtained by augmenting human performance. Projects from the 1960s effort such as A-VIS, MDS, TOPPS, TOP, PIMO, SIMMS, and other noncomputer-based concepts and systems set out to accomplish human performance improvement. Current AI researchers should be encouraged to examine some of these projects and system reports.

To avoid compromising residual security concerns, or any of my colleagues, I have omitted all references to the places of this research and members of the multidisciplinary team which developed the systems described. Interested AI researchers with appropriate information needs can find information about the projects through DARPA and other official channels. And I, of course, will be glad to discuss further

any underlying concepts and techniques applicable to such systems.

Keith W. McCammon
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Editor:

I am a relatively new member of AAAI. My primary interests are in expert systems and the Lisp language. Your AI Magazine is a valuable source of information for those of us exploring the practical application of AI in the work environment. My particular efforts are currently directed toward studying the benefits and cost effectiveness of developing an expert system for use in the field of personnel administration in the Federal Government. While there are other sources of information to assist me in my study, the AI Magazine has been most fruitful. I would definitely encourage you to expand on the frequency of this fine publication. Quarterly issues are simply not enough. Please give us a monthly magazine.

Loren D. Martindale
Yuma, AZ 85364

We appreciate your comments However, it's hard enough to produce the magazine four times a year. —Ed.