The Divided Mind of ARTIFICIAL INTELLIGENCE

In Silicon Valley, the best and the brightest are developing weapons that think. Now some of these high-tech wizards are beginning to think twice.

BY DAVID BEERS

Less than two years ago, Pierre Blais was busy at work on the CIA's central brain. A practitioner in the esoteric realm of artificial intelligence, Blais was part of a team contracted to build a computer system that would automatically take in messages from sources all over the world, "read" them, reformat them and then route them to appropriate desks inside the giant Central Intelligence Agency headquarters in Langley, Virginia. The work was not only stimulating, it was lucrative: Blais was earning enough to settle into East Coast upscale suburbia and assure his wife and three daughters a future of cozy affluence.

Today Blais has traded the sprawling CIA headquarters for a funky frame house in Santa Cruz where a handful of ardently antimilitary hackers are trying to create artificial intelligence for the masses—a program that will run on IBM PCs instead of CIA mainframes. For his contribution he is paid in "maybe money"—maybe, if the company ever turns a profit, he'll receive a check. Blais and his family now live in a compact tract home in a scruffy corner of San Jose—a house he may have to sell to stay ahead of the bill collectors.

Pierre Blais is quite sane. But he is not what most in defense-dollar-flooded, technology-happy Silicon Valley would call normal. The problem is that two years ago Pierre Blais began to develop a nagging conscience.

Blais started to study up on the CIA, and the more he learned about its government-toppling adventures the less comfortable he felt about adding to its power. Later, Blais came to the conclusion that artificial intelligence or AI—the attempt to create machines that emulate human reasoning—has been commandeered by America's military establishment and is being enlisted to help create a new generation of ill-conceived and macabre weaponry.

Blais is not alone in his concern. Based on interviews with other AI designers and researchers in the Palo Alto area—what could arguably be called the artificial intelligence capital of the world—many in this rarified domain seem to be wrestling with their consciences. Each person interviewed hit on the same two themes: In the high-tech world, cutting edge AI work can be the most exciting high of all. And these days it is very difficult to find an AI company or research lab that isn't taking money from the Defense Department. Therein lies these wizards' dilemma.

Pierre Blais looks the part of a "knowledge engineer"—40 years old and tall, with sandy hair receding a bit at the forehead, wire-rimmed glasses and clothes that look to have come off the no-nonsense rack at Sears. As a teenager in Montreal, he was a self-described juvenile delinquent who rode with a motorcycle gang and fantasized about becoming a Green Beret. In 1966, a time when many American youths were fleeing over the northern border to avoid the Vietnam draft, Blais, a Canadian citizen, headed south to Plattsburgh, New York, to enlist with the Army's 101st Airborne Division.

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"I wanted to see some action, and the Canadian armed forces weren't doing anything. I saw it as a rite of manhood," he says in the measured, precise tone of a technician, a tone that Blais rarely abandons.

By January of 1968 he was running search and destroy missions smack in the middle of the Tet offensive. Blais earned a Bronze Star with a "V" for valor for his part in ambushing a platoon of North Vietnamese. But the romance was already gone. He remembers arriving in Hue, a city on Vietnam's central coast, to find "thousands of bodies, most of them civilians, stacked like cordwood along the road, with rats running all through them." Fellow platoon members tortured and shot a captured enemy soldier while Blais, paralyzed with horror, stared at a confiscated photo of the man's family. Some nights, as he stood guard outside his camp, Blais would find himself crying and praying for deliverance.

Honorably discharged in 1969, Blais returned to Canada, studied business and mathematics at McGill University in Montreal and tried to reassemble his life. "What happened in Vietnam is that all the myths about life had been shattered. All the myths built by my family, my school, my society, nation, history, all of these were shattered in one blow," Blais says. It left him with a philosophy of "pure nihilism plus pure pessimism. But I wasn't ready for that. I was too young."

One day some Mormon missionaries knocked on his door. Blais liked what he heard about the New Zion, an idyllic society out west bound by strong values of church, family and honest work. He joined the church, met and married a fellow convert from Okinawa and enrolled as an undergraduate in international relations at Brigham Young University in Provo, Utah. Later he went on to complete a master's program in Asian studies there.

At BYU Blais found himself part of a small but growing cadre of academics convinced that international crises like the Vietnam War could not only be modeled but predicted using a computer. His mentor and graduate thesis advisor was Richard Beal, who had designed computer systems for the CIA and who later went on to become President Reagan's special assistant for national security affairs before his death in 1984.

By 1980 Blais's eclectic resume was attracting job offers in the southern California area, and he eventually went to work for Logicon, a Torrance company heavily involved in AI work for the government's military and intelligence arms. He was awarded a top-secret clearance and assigned to the SAFE project—the new computer-controlled nerve center of the CIA. Eventually Logicon moved the Blais family back east so that Pierre could be minutes from CIA headquarters. He was getting paid nearly $40,000 a year to solve the most exhilarating technical problems he had ever tackled.

But then the nagging doubts began. In November of 1984, Blais helped organize a conference of Vietnam vets against the CIA mining of Nicaragua's harbor, and made several speeches. Meanwhile, at work, the projects crossing his desk struck him as crazier and crazier—including one two-inch-thick proposal to develop a system for reading another person's mind by recording and analyzing his or her every blink and twitch. He remembers buttonholing the proposal's author and saying, "This is immoral, it's 1984 stuff."

"Don't worry, it's just for using on the Russians, in things like arms negotiations," his colleague responded. When Blais shot back, "C'mon, what makes you think the CIA has any compunction about using this stuff on its own people?" the coworker clammed up.

In December of 1984, Blais was summoned by the CIA for a polygraph test. He claims he answered every question truthfully, sure there was nothing damning about his background—an arrest

for minor theft in 1964, the selling of some hashish in 1971—that the CIA didn't already know after clearing him two years before. One month later, news came that his clearances had been yanked. For the next eight months he fought the agency, demanding to know the specific reasons for its decision. Blais claims that in their last telephone conversation, the CIA security officer handling his case —a person he never met and whom he knew only by pseudonym —candidly admitted that the clearances were pulled because Blais was too much "a person of his own mind."

CIA representative Kathy Pherson would not confirm or deny Blais's claims, saying, "The agency does not comment on the security process or who has what clearances."

Blais says that by the end of the tussle he didn't care about the clearances anymore, so disillusioned was he with defense contracting. Shortly afterwards, he resigned from Logicon.

By last February, Blais had made a clean break from his past —or so he thought. Logicon and the CIA were behind him. S6 too was Mormonism. He and his wife had abandoned the church, disagreeing with what he calls its "authoritarianism and weird apocalyptic nationalism." There was relief and eagerness in Blais's voice a year ago as he discussed his fresh start, a $45,000 position at one of Palo Alto's leading commercial AI firms, Teknowledge, which caters to industries like oil and finance much more than to the Department of Defense. Now his days were filled with the task of mastering an advanced programming language called LISP. He had started a discussion group on science policy issues like the Strategic Defense Initiative (Star Wars) and found over a dozen coworkers open and interested.

What Blais couldn't foresee at the time was the extent to which Pentagon money had penetrated even commercial AI companies. Nor could he prophesy that he would become deeply disillusioned with the field, and that six months later he would be out of a job at Teknowledge—and possibly out of artificial intelligence altogether.

Just what is artificial intelligence? After 30 years of research, specialists in the field are still asking that question. Stanford computer science professor John McCarthy coined the term in 1956 to describe the first stabs at duplicating human thought with a computer, including a working program that proved theorems in logic. In 1957 two other AI pioneers, Herbert Simon and Allen Newell, predicted that within a decade a computer would be the world chess champion, discover and prove an important mathematical theorem and compose beautiful music. None of those predictions has happened yet, but the field keeps expanding.

Among Bay Area firms claiming to be in the AI business are those trying to develop machines that recognize human speech, those attempting computers that can be programmed in plain English rather than mathematical languages and those working on robots that "see" or "feel" and react accordingly.

Teknowledge and rivals like Mountain View-based Intellicorp build so-called "expert systems," perhaps the most tried and proven examples of AI, if not the most sophisticated. One of their knowledge engineers spends a lot of time with, for example, a hotshot mechanic, observing and charting his or her decision-making process, then programs that expertise into a computer. Less experienced mechanics can turn to the computer for advice when they are stumped. Stanford has developed a similar, far from perfect, system for diagnosing infectious diseases. All these endeavors remain at such an experimental stage that a joke is making the rounds among computer scientists: "If it works, it's not AI."

The Department of Defense has invested too much in artificial intelligence research and development to find that one funny. Since

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the early 1960s the department—specifically its Defense Advanced Research Projects Agency (DARPA)—has been the main source of funding for AI explorers, and by the early 1980s it was giving them between $20 million and $25 million a year, according to the congressional Office of Technology Assessment. Most of that went into university labs for very theoretical research, with the rare real-life product usually something no more threatening than a chess program. The Pentagon signed the checks, but gave little direction.

That picture changed radically in 1983 when the Reagan Administration marshalled its Strategic Computing Initiative (SCI) —a $600 million, five-year crash program to provide the military with "intelligent" weapons. Suddenly AI research became much more focused. The Air Force is to receive an electronic "pilot's associate" able to converse in English and help with navigation and picking targets. The Army is slated for an "autonomous land vehicle"—in essence, a tank that drives itself. The Navy and Army are each to have a "battle management system," which will keep electronic tabs on friendly and hostile forces alike and give strategy advice to those in command.

All of these projects not only represent a quantum leap forward in AI programming, they require computer hardware many times faster than today's on which to run it, so SCI has earmarked millions for new computer-chip technology as well. In 1986, DARPA awarded more than $140 million to SCI, and if anything, the program is gaining momentum as it passes the midway point of its first five-year phase. Harvey Newquist, editor of *AI Trends*, echoes the consensus among AI watchers when he says "$600 million will only be a down payment on billions more to follow if SCI is to ever meet its goals."

Meanwhile, specific branches of the military are nurturing their own pet artificial intelligence projects outside of SCI. The Army is particularly enamored of AI, judging by a recently circulated sheaf of proposal requests. It wants, for example, "terminal homing munitions. . . intelligent projectiles and missiles which will search for stationary and moving armored vehicles. . . Since the decision of which target to attack is made on board the weapon, the THM will approach human intelligence in this area."

It also wants AI-equipped robots for use in "NBC environments;" that is, areas contaminated by nuclear, biological and/or chemical weapons. The U.S. Army Quartermaster School in Fort Lee, Virginia, has put in a request for one that would roll through a body-strewn battle site, "detect and identify NBC contaminants, decontaminate human remains, inter remains and refill and mark graves." If that seems a rather bizarre desire, it is shared by more than one visionary in the ranks. In a 1982 Army War College report, Lt. Col. Dennis Crumley forecasts that one day, "When evacuating the dead, [robotic vehicles] could be loaded and, by merely activating a switch, dispatched to the nearest mortuary."

And then there is SCI's much richer cousin, SDI, the Strategic Defense Initiative. Star Wars research is projected to zoom to $10 billion a year by 1991—more than the cost of the MX missile or B-1 bomber in their peak years of production. Just how much of that will go to AI is still uncertain, but even 15 percent would nearly double the present rate of AI military funding, which this year will top $170 million, according to congressional estimates. By contrast, the next closest federal funding source, the National Science Foundation, has about six million AI dollars to play with.

Ask Joel Shurkin of Stanford University News Service how much money the Pentagon pours into his university's AI projects and he just whistles. "We have three robotics labs alone," says Shurkin, who writes press releases about the latest AI developments on campus. Shurkin estimates that Stanford's AI projects receive "about $5 million" in defense money. More precise figures are hard to get because many departments, from electrical engineering to philosophy, are conducting AI work, and few are willing to give a funding breakdown.

Stanford reflects the general trend in computer science research, according to AI observers. Nationally, even counting big contributions from the IBMs and Hewlett-Packards of the commercial world, "most academic computer science research is now directed by military agencies," writes UC Berkeley computer science professor Clark Thompson in a report published in the July issue of *Communications of the ACM*, a technical journal of the Association for Computing Machinery. By other rough estimates, three-quarters of all the nation's computer research is now being funded and developed for the military.

For those who dream of creating thinking machines, but find thinking weapons a nightmare, the military's newly aggressive AI program creates wrenching dilemmas. Lucy Suchman is an anthropologist who studies how people interact with computers at Xerox's Palo Alto Research Center, an AI think tank nestled among rolling grassy hills and BMW-filled parking lots. It has always been against her principles to accept military money, Suchman says, but these days she finds herself helping with a partly DARPA-funded project. Even though the work is so abstract as to have no immediate weapons use, Suchman says it bothers her just the same. When it comes to government spending, "we have gone way beyond our real requirements in terms of national security and defense, and we are sorely neglecting human services," she says. "I don't want to legitimize the current structure of things by saying, 'It's OK, I'll take that money.' "

Suchman says it makes her sad to see very unwarlike colleagues "organizing their work around military applications" in order to land grants. But she understands the pressures. To receive National Science Foundation funding, she says, "you have to write an enormous grant proposal, which is subject to very stringent peer review, and at the end of it you get a couple hundred thousand dollars." At money-laden DARPA, by contrast, "a lot of it has to do with personal contacts. There's no peer review, no clear set of requirements—just describe what you're doing, suggest its relevance and capture the imagination of someone in the Pentagon."

That much cash swirling around has created a powerful vortex, pulling at all corners of the AI world, indicates the Office of Technology Assessment's Fred Weingarten, who is directing a study on the state of AI research: "We're finding a lot of AI designers who say they can't do long-term research anymore; if they want to get funded they have to work on short-term military applications." And the new push for intelligent weapons, those designers tell Weingarten, means "there's a lot of untapped potential that we're going to be sorry we didn't explore. Maybe we'll be sorry in the marketplace because other countries may develop key civilian applications first. Maybe we'll be sorry from a social perspective because we've lost opportunities to improve our education or health system."

Brian McCune, cofounder of Mountain View-based Advanced Decision Systems, is one AI whiz who read the writing on the wall and is prospering because of it. When I talked to him last summer, he bragged that his seven-year-old company had just snagged a multimillion-dollar contract large enough to move the firm from seventeenth to tenth on the list of Bay Area Star Wars contractors. Advanced Decision Systems is building SDI's "command and control decision aid test environment," McCune claims. When the missiles start flying, he says, "somehow you need to boil down everything that is going on in a globally distributed computer system for a few human decision makers." And that's a job for AI, according to McCune.

Advanced Decisions System, which according to McCune has grown 50 percent over each of the last three years and in 1986 grossed over $10 million, is also hard at work on the electronic brain for the Army's autonomous land vehicle along with several other SCI contracts. "We're the largest company dedicated to government applications in AI," states McCune, who was well prepared as a student. "A lot of my research at Stanford had been paid for by DARPA, so I was already hooked into that network. If you want to be in the research area at all, then you want to work on hard, state-of-the-art problems. And defense applications are the hardest,

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most stimulating of all."

Meanwhile, other AI designers who read the writing on the wall, and don't at all like what they read, are beating a path to the Palo Alto headquarters of Computer Professionals for Social Responsibility, a nonprofit organization with chapters in other high-tech centers like Seattle and Boston. Executive director Gary Chapman says that a disproportionately high number of new members in the 280-strong local chapter are AI experts. Maybe that has something to do with the average AI expert's background, which commonly includes philosophy, psychology and other social sciences as well as hard-core "hacking." AI designers are paid to be introspective—like poets and psychotherapists, they spend a lot of time trying to figure out how and why people think the way they do.

Behind the moral musings, though, are some hard technical doubts. AI expert systems work reasonably well for car fixing, tax accounting and pill prescribing because those are narrow, well understood and predictable endeavors. But the chaotic world of war fighting is quite a different matter. "Our concern is that increased reliance on artificial intelligence and automated decision making in critical military situations, rather than bringing greater security, leads in an extremely dangerous direction," wrote computer scientist Severo Ornstein, Lucy Suchman and Stanford computer science professor Brian C. Smith recently in the *Bulletin of Atomic Scientists.* Because firsthand experience teaches that no computer system is perfect, least of all AI versions, "we argue against using them for decision making in situations of potentially devastating consequence."

Chapman summons another Frankenstein-like apparition of AI run amok. He reaches in his desk and pulls out a public relations photo of Grumman Corporation's experimental Robotic Ranger. Atop four dune buggyesque wheels sit two bazookalike barrels, and atop these is mounted a video glass eye that, according to the caption, "provides autonomous target acquisition" and "IFF (identification friend or foe)." Chapman's translation: the machine is supposed to decide on its own who the enemy is, then blow the target away. Grumman representatives point out that a human monitor, controlling the Ranger with a three-kilometer-long fiber optic thread, would have the option of overriding the robot's decision to shoot.

Chapman says that because such "killer robots" would remove the human component in war making, they constitute "the next crisis in scientific ethics, on a par in historical significance with the development of nuclear weapons." He believes these types of weapons are banned under Geneva Convention rules. After consulting with experts in international law—including retired Gen. Telford Taylor, who was chief U.S. prosecutor at the Nuremburg trials —Chapman feels that his case is strong enough to take to the United Nations and World Court, and he plans to mount a public campaign soon.

Other battles against the Pentagon's AI schemes are being waged quietly out of sight, within the walls of AI companies themselves. A 26-year-old knowledge engineer at one of the leading Peninsula AI firms who requests anonymity says he was unnerved to hear that his company recently landed a $1.5 million piece of the Army's computerized battle management system. "It's a weapon to coordinate killing on a large scale," says the AI whiz, who claims most of his colleagues don't want to work on the project any more than he does.

Recently he and fifteen other employees met with higher management and proposed some new ground rules: From now on, before proposals are submitted to the Pentagon, all employees must be informed and have some say in the matter. No more AI designers should be given military security clearances. Finally, before any person decides whether to work on a military project, he or she must hear arguments from their coworkers. The young knowledge engineer thinks there is a good chance the requests will be approved. "After all, we're highly trained specialists, so we have a little more bargaining power than the Watsonville canners."

The former philosophy major assesses the stakes this way: "We can basically be really productive people or we can piss away our lives building systems that at best will not be used and at worst will add considerably to the misery of the world."

U nlike those AI designers who grudgingly take military money under certain conditions, Pierre Blais is a purist. And he has paid for that.

By last summer, when Blais and I spoke again, his enthusiasm about his new job at Teknowledge had turned to disgust. He had never really fit in at Teknowledge, he said. The work was challenging, but so removed. He was too preoccupied with the war in Central America and, increasingly, with the military's grand plan for artificial intelligence. When Blais considers the promise and peril of the AI field today, he worries that "we're like the unquestioning German scientists under Hitler. Whatever destructive technology you create for the military is eventually going to be used—and that goes for artificial intelligence. I'd already seen how we used technology in Vietnam—agent orange and napalm." At the end of July he was fired for unsatisfactory performance, a charge with which he has no quarrel. Blais says he never was able to throw his all into the technical tasks expected of him.

The first blow came when he was taken aside one day and asked, "You know about the peace clause, don't you?" Blais said he was aware of a provision in the company charter stating that weapons contracts were to be discussed openly and that no one could be required to work on one. It was one of the reasons he was attracted to Teknowledge in the first place. "Yes, well don't broadcast it to outsiders," Blais was told. "You know, we would lose government contracts if they found out about this." "I just shook my head in disbelief," Blais says.

Blais knew that Teknowledge had a small subsidiary in Thousand Oaks that did nothing but military and intelligence contracting. That didn't bother him, because as he understood it, the main operation in Palo Alto was overwhelmingly geared toward commercial applications. But in the spring, Blais learned of Teknowledge's latest marketing triumph. "I found out we had done a dog and pony show in front of a conference that was totally dedicated to building AI systems for the military, and that we had won the highest award for impressing the customer. Some coworkers I know were rather horrified to learn we had such a symbiotic relationship with the Defense Department." As it turns out, three of Teknowledge's leading experts were busy at work on a Pentagon-funded battle management system component.

Blais says his hands never again felt clean working on Teknowledge projects.

All the while, a gulf was growing between Blais and the leading AI designers at work, a group he calls the "tekkies." Most were single, at least ten years younger than Blais, and their abilities with a computer were unquestionably dazzling. "They were the best and the brightest, but so utilitarian. They seemed to have no consciousness about the world outside." When Blais would want to chat about politics, philosophy, anything but AI, the tekkies would give him the distinct impression that he was wasting his time, he says.

That was a criticism to which he felt vulnerable. Immersed in a strict and demanding course on Teknowledge's brand of AI, Blais often felt on the verge of drowning. He had passed the first set of

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evaluations, but with no gold stars. Some tekkies implied he might not have the right stuff. "One told me I had trouble forming mental models," Blais says.

The crash came June 26, the day after Congress approved $100 million in military aid to the contras. Blais arrived early, flipped on his terminal, tapped a message into the electronic mail system and routed it to every Teknowledge employee. It said: "This is a day that will live in infamy in the history of this country."

"Everybody yawned," Blais laughs acidly. "I got one angry message from a sales rep in Michigan who called me an appeaser and compared me to Neville Chamberlain."

Blais next ventured out of his cubicle and started ranting at a coworker whom he knew supported the contra aid. "I said, 'If you're so sure, why don't you put your bod where your mouth is? Why don't you grab an M-16 and shoot a few people? Why don't you do that instead of retreating into your moral cowardice? Why don't you do that instead of advocating that our money be used for others to do the killing for us?'"

After that, says Blais, he began to be assigned less interesting work. By the end "it was something a twelve-year-old could do." On July 31 he was terminated with two months severance pay. Teknowledge spokesman Mike Ayers declines to comment on Blais's job performance or explain why he was eventually let go, calling it a private matter. Exactly a week later Blais joined with other northern California Vietnam veterans in a protest against U.S. policy in Central America, returning the Bronze Star he had won in Vietnam.

Nowadays Blais divides his time between organizing more protests by Vietnam vets and making the rounds in his double-knit suit in search of another job in high tech. He doubts he'll find a solid niche in AI—everywhere he has interviewed so far is receiving DARPA funding, and that disqualifies them as far as he is concerned.

In the meantime, it's hard to call what he does for Sapiens Software Corporation a job. Blais has worked for the Santa Cruz start-up company without pay—on maybe money—for two months. Twenty-eight-year-old Katherine Kelly, the firm's blond, beautiful and savvy president, turns down job offers from big Silicon Valley companies often. Vice president John Hare, 31, bespectacled and elfin, is a software master who claims he has found a way to make a souped up IBM PC design and run AI expert systems. A steady flow of UC Santa Cruz grad students grind out nuts and bolts programming. There is also a striped cat, which sleeps here and there about the homey cottage that serves as corporate headquarters.

Blais drops in, when time and finances permit, to fine tune programs and teach Hare what he knows about LISP, the AI programming language. In return Hare teaches Blais about his specialty, C, a powerful language for programming microcomputers like the PC. Blais says one company practice keeps him coming back, pay or no pay: whenever a request for a Sapiens product arrives in the mail from a Defense Department-connected buyer, it is swiftly filed away—the company does not accept military orders or contracts. "We created this company for brilliant minds who don't want to work for the military," says Kelly, who founded a Santa Cruz chapter of Computer Professionals for Social Responsibility. "We're also making a product that is marketable," she quickly adds.

Blais thinks she may be right—"The idea is sound, even if there are some big hurdles to clear before all the bugs are out"—but he doesn't know if he'll be around when all the red ink turns to black. Because his own finances are already shot, he is considering moving to New Zealand, Japan or "some other country where they need

high-tech people, but are more serious about peace." Or he may jettison high tech altogether, and seek a teaching job in the field of his master's degree, Asian studies.

It would be high tech's loss, John Hare says: "Pierre knows computer languages, he's been around the block. When I started teaching him C, he learned it two orders of magnitude faster than the average beginner [or a hundred times faster, in layperson's language]. He's damn competent."

Damn competent, but does his obsession with the military's agenda get in the way of his talent? Some people might want to write Blais off as one more traumatized Vietnam vet. Says Hare, "Some vets are more shaken by the experience than others. Pierre has about the healthiest reaction you can imagine. He became politically active, and he's really dedicated to peace. The fact that he's a Vietnam vet makes him an intense person. Fine. Intense people are my stock in trade."

Blais himself says, "If so-called post-Vietnam traumatic stress syndrome is moral pain, then I have it." And he's all but given up hoping for a cure that would also allow him to be at the forefront of artificial intelligence.

"All the time I've worked in the computer field, it's been for some sort of military project," he says, standing on the wooden porch of Sapiens' headquarters. "Seems like you can't get away from it. Today I just want to cut the umbilical cord." □

Postscript: As this story went to press, Sapiens received a small but life-saving infusion of investment money, allowing the company to move into new, more upscale quarters. Blais, for the time being, is a full-time employee, making one-third less than he did at Teknowledge. Ironically, his job is subsidized in part by a training grant from the Veterans Administration.