

Just have your elves call my elves

Software aides learn to anticipate every desire

By Elizabeth Weise
USA TODAY

MARINA DEL REY, Calif. — For the sake of science, Milind Tambe has traded his secretary for an elf. True to its name, the elf has caused him no end of mischief.

Tambe's elf is a self-learning, self-acting computer program, one of 15 developed by Tambe and his colleagues in an artificial intelligence project at the University of Southern California's Information Sciences Institute.

The elves — all named Friday, after Robinson Crusoe's helper — have taken over the eight-person Electronic Elves Project's scheduling and meeting planning. They even order lunch for the team.

Tambe's Friday learned quickly that if Tambe was running more than 10 minutes late, he had a tendency to cancel meetings. So one day when Tambe was delayed, Friday took it upon himself to send out a last-minute cancellation. Unfortunately, the meeting was with Tambe's director to discuss the project's funding for the next year.

Aghast, a project assistant called Tambe to confirm. After a slight adjustment of priorities, the elf went back to running Tambe's schedule.

On the positive side, "you don't have to worry about elves gossiping," Tambe says.

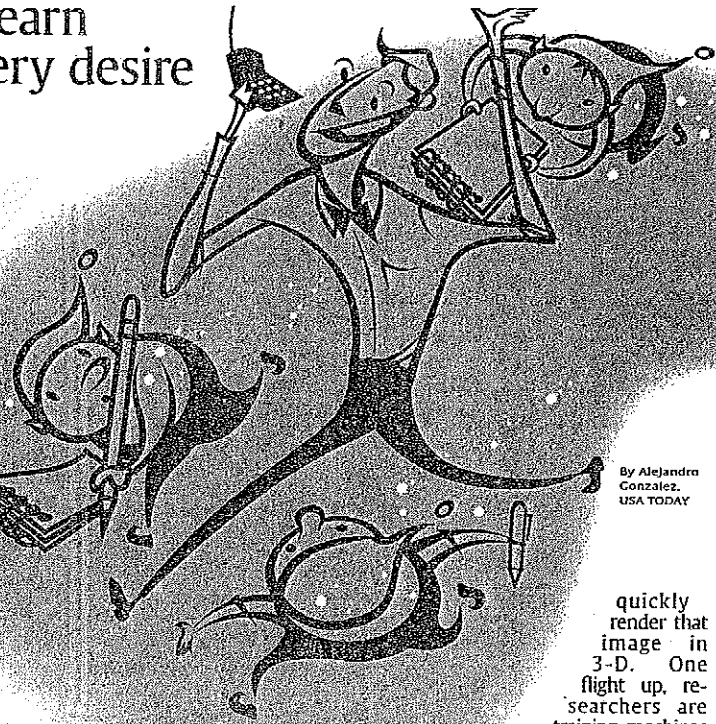
Leaving the organization of your life in the hands of technology is always dicey; for most of us, just dealing with pocket organizers stretches our patience. But the Electronic Elves Project pushes the limits of the possible. The elves don't just interact with their owners; they interact with one another, without human intervention, and take action on their own initiative.

Blending humans, software

The project is financed by the federal government's Defense Advanced Research Projects Agency (DARPA), the same agency that created the Internet 30 years ago. It's "one of the first projects to demonstrate that humans and software agents can be blended together seamlessly," says James Hendler, program manager in the information systems office at DARPA.

Friday and his kin show "how agents can be significantly more capable than other software approaches, performing tasks based on human goals and reacting to changes in the environment based on human needs," Hendler says.

The elf "conclave," as the researchers



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call it, includes one elf for each participant, plus several helper elves, including information and schedule agents. Using information supplied by their masters, they decide which researcher will deliver the week's lab presentation, as well as which meetings to postpone and which to cancel.

The results were originally designed to show up on participants' Palm digital assistants. But of late, users have taken to doing most of their "talking" to their individual elves on cellphones that provide Web access.

"What I like about it is that these shoemakers are trying out the shoes themselves," says Tim Finin, a computer science professor at the University of Maryland who also works on autonomous agents. "They really use these things on a day-to-day basis. I've been with Milind many times, and his phone's constantly going off, and it's his agent trying to set something up. It's very neat."

The non-descript Information Sciences Institute building overlooks Los Angeles' stunning Marina del Rey harbor. Inside, the sight of denim-clad engineers being ordered around by their Palms isn't unusual. On one floor, scientists are busy mapping an ant's brain using X-rays to test a method of remotely harnessing the computing power of a dozen university supercomputers to

mail message. It was his elf, reminding him that he had a 9:30 a.m. meeting and that it was 9:25. Using Tambe's GPS locator, the elf knew he was several miles from the office and couldn't possibly make it on time. It gave him the option of postponing the meeting by 10, 15 or 30 minutes or canceling it.

Tambe chose to postpone by 30 minutes. The elf then networked with the elves of others scheduled to attend and passed the word.

DARPA hopes that someday intelligent computer programs will simplify logistics for complicated military operations. Elves assigned to individual soldiers would work in real time, making split-second changes based on updated information about enemy troop movements and casualties. "They'll act as proxies," says Pynadath, whose work focuses on decision-making in multi-agent environments. "They'll provide swift reaction in a crisis."

'Combat elves' possible

The defense agency believes that "combat elves" could be used in command and control, Hendler says. "Knowing what is happening on the battlefield, and using that information appropriately, is becoming more difficult as our forces become more sophisticated, flexible and capable.

"Software that can automate some of this burden, allowing humans to ignore some of the pesky details and focus on the big picture, should significantly improve the speed and accuracy of U.S. military forces."

The ability to do logistical shuffling makes the Electronic Elves Project of interest to more than the military. NASA, for one, has put out feelers. "They've been talking about possible use of agents on the space station," Tambe says. Agents could help a space station crew get more done and save trips — and therefore lots of money.

Another possible use of the agents: commercial airlines, which must coordinate the schedules of pilots, flight attendants and maintenance personnel, all in accordance with complex federal laws governing who can work where and for how long before taking a break. Anything that could streamline the process and remove waste would be invaluable.

This may seem cutting-edge now. But Maryland's Finin thinks such agents will begin showing up in consumer cellphones and Palms soon. "I would guess within two years this will be fairly common as a way to help you, if you have an Internet-enabled device."

quickly render that image in 3-D. One flight up, researchers are training machines to translate Sinhalese and Tamil, the main languages of Sri Lanka, into English.

Because much of the research the institute does is government-funded and sensitive, scientists must use security cards embedded with computer chips to access each level and individual labs. Originally, Tambe's group planned to tie its elves into the building's security system, so the elves would know where their masters were at all times.

"But when we tried to explain to security that we wanted to open their entire system up to a bunch of autonomous computer programs ..." researcher David Pynadath says, pausing as his colleagues burst into laughter.

"Let's just say they didn't go for it," Tambe finishes.

Elves tap into GPS locators

The Electronic Elves Project is the first instance of a real-world use of truly autonomous programs. "It's a living laboratory," says Phil Cohen of the Center for Human-Computer Communication at the Oregon Graduate Institute of Science and Technology in Portland, who has followed the research. "Not many organizations use what they build when they're doing really advanced stuff."

Each researcher carries a small Global Positioning System (GPS) device that is synchronized to his or her elf, allowing it to pinpoint the person's location within a few hundred yards and make decisions based on that information.

On a recent trip from the Los Angeles airport to the institute, Tambe's phone beeped him that he had an incoming e-

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