

# MODEL BEHAVIOUR

Semi-intelligent virtual agents displaying their own independent behaviour are coming to a life-size screen near you.

BY DAVID BRAUE

**H**UMVEE AND CAR ARE STOPPED at an intersection, parked at an angle that makes it clear something is wrong. As you get closer, it's obvious what has happened: the military vehicle has smashed into the small car, injuring a child who is now lying motionless on the road. The mother is kneeling next to her, screaming for bystanders to help.

You approach the mother, hoping to settle her down and locate treatment for her child, but she is beyond calming. The Humvee's driver pleads for your attention, loudly defending his mistake. As the crowd of bystanders thins, the mother's cries become more desperate. She abuses you in her anguish, becoming increasingly hostile until she is distracted by the arrival of a rescue helicopter.

Accidental civilian casualties are the bane of any soldier, and that's why this scenario is one of several created for a virtual-reality project run by researchers at the University of Southern California in conjunction with

the United States army. While it seems real, the simulated setting, vehicles, people - everything around you - are a figment of a computer's imagination, projected onto a life-size screen that makes participants feel like they're in the middle of the action.

The effect is so realistic that some participants have broken down in tears from the stress. Others become so frustrated with the mother that they start screaming at the screen, with every word - translated by speech-recognition software - only making her more upset. "They're actually irritated by the fact they can't control this character," says Stacy Marsella, a research cognitive scientist with USC's Information Sciences Institute and one of 471 researchers from 29 countries gathered in Melbourne for the second annual Autonomous Agents and Multi-Agent Systems conference ([www.aamas-conference.org](http://www.aamas-conference.org)).

Agents - or semi-intelligent virtual beings with independent behaviour - differentiate the onscreen scenario from the average 3D

shoot-'em-up. In this virtual world, the woman, child, soldier and crowd members are all agents whose personalities are determined by settings that make them friendly or hostile, defensive or antagonistic, calm or agitated.

Onscreen characters "have sophisticated models of dialogue, emotions, coping strategies and goals", Marsella says. "We've studied the psychological literature - in particular, cognitive theories of emotion - which truly model emotion as a process by which people analyse events in terms of how they relate to their personal goals and concerns. It allows us to manipulate the environment in ways that engage people, making it entertaining but also a learning application."



## TRADE RELATIONS

### AGENTS SIMULATING HUMAN BEHAVIOUR ARE BEING APPLIED TO COMMERCIAL USES.

Work developing agents has been done mostly by research institutions and universities but Melbourne company Agent Oriented Software has moved the technology into the commercial sphere using JACK Intelligent Agents, which automatically generate agents that behave according to specified parameters.

Formed in 1997, AOS has successfully built up a \$2.5m annual revenue stream through

partnerships with a variety of defence-related organisations, which use agents to simulate humans and human behaviour in a range of adverse conditions.

Australia's Defence Science and Technology Organisation uses JACK-based agents to simulate pilot behaviour in flying tests, while AOS recently won a deal with Britain's Ministry of Defence to create agent-based "soldiers" that can be tested virtually to see how they



### CHOPPER SQUAD

JACK-based agents are used to simulate flying the army's latest recruit, the Eurocopter Tiger

respond to fear, fatigue and other battlefield issues.

"We're modelling behaviour in simulations that get intelligent agents to behave in a more human way," says AOS business applications manager Nick How-

den. "We're looking to build a cognitive level on top of the JACK agent, so we can look at perception, memory and so on, to see how they are affected by behaviour modifiers." - DAVID BRAUE



The peacekeeper application is just one use for the technology driving these artificial people. Other ISI applications include Carmen – a scaled-down virtual human used to teach coping skills to parents of child cancer patients – and an upcoming effort to create immersive environments for teaching foreign languages and cultural customs. Other projects envision agents as mentors for students using online learning applications.

The approach was tried on a far smaller scale when Microsoft added its much-maligned “Clippy” and other agents to its Office productivity application. While the rudimentary artificial intelligence was a step forward, the tendency of the agents to step in when they weren’t needed – particularly for advanced users who generally like to be left alone – made them more of a nuisance than a help.

W. Lewis Johnson, director of ISI’s Center for Advanced Research in Technology for Education ([www.isi.edu/isd/carte](http://www.isi.edu/isd/carte)), leads a study into making agents less arbitrary and more useful in educational settings. One of the biggest obstacles is that making anthropomorphic agents too realistic skews expectations, he says. People become frustrated when the cognitive limitations of agents are revealed. “People have a tendency to interact with computers in a way that is similar to the way they interact with people,” Johnson says. “These responses are hard-wired in us, so agent technology tries to take advantage of that in a positive way by being supportive and empathetic. We’re also trying to incor-

## WE’RE TRYING TO INCORPORATE MORE OF THE SOCIAL NICETIES THAT SMOOTH OVER PROBLEMS IN HUMAN INTERACTION //

W. LEWIS JOHNSON CARTE DIRECTOR

porate more social niceties that smooth over problems that occur in face-to-face human interaction – for example, the use of indirectness to avoid being too blunt in criticism.”

While CARTE researchers try to teach human-like agents how to be tactful, others focus more on the inner workings of agents with, for example, ways to co-ordinate many agents for a single task or to optimise interaction between humans and agent-powered software. The latter issue is particularly relevant for NASA, which relies heavily on agents for monitoring systems necessary to maintain life in self-sustaining environments that may eventually support humans on other planets.

Unlike ISI’s creations, NASA’s agents are prized for their predictability, which is crucial in keeping a continuous watch over systems for recycling water and air, maintaining environmental pressure, running heaters, monitoring

## VIRTUAL MODELS

### THE CHALLENGE IN CREATING VIRTUAL PEOPLE IS TO MAKE THEM CONVINCING.



Giving agents human-like personalities is one thing but making them look like real people is another. For Catherine Pelachaud, a University of Paris

researcher who earned her PhD from the University of Pennsylvania’s Center for Human Modeling and Simulation (<http://hms.upenn.edu>), modelling the subtle features that accompany speech has been a long-term endeavour reflected in



“Greta”, a virtual human whose features reflect the anatomical mechanics of human speech.

Greta, whose movements are controlled using the Affective Presentation

Markup Language (APML) code developed at the University of Rome, is one of many avatars – virtual representations of living beings – helping to give computerised agents a convincing face. The real challenge in creating virtual people,



Pelachaud says, is not making them talk but making them do so convincingly enough that they don’t look like cookie-cutter people.

Increasing expressiveness is one way to achieve this, she says. “Most agents created so far have been very generic. We’ve presented a set of parameters to define a person using four or five parameters that change their gaze behaviours. The important thing is that you build models that convey the meaning that the agent wants to tell you.” – DAVID BRAUE

plant health and so on. Such agents have been developed and run successfully for years on end at NASA’s Johnson Space Center in Houston, Texas, where “man-in-a-can” tests seal would-be interplanetary travellers inside a self-contained environment.

Durability, however, is only the first part of the challenge. The rest? Finding the right balance between human and agent control of these systems so that agents can provide help to a certain point but get out of the way when humans need to step in.

“You have to be watching for anomalies,” says Cheryl Martin, of NASA’s TRACLabs. “Control agents have a control space they know how to keep [systems] within, and if settings get towards the edge of that control space, they can bring it back. But if something really goes wrong, there’s always going to be a boundary at which someone else, who knows the larger picture, needs to step in.” ●