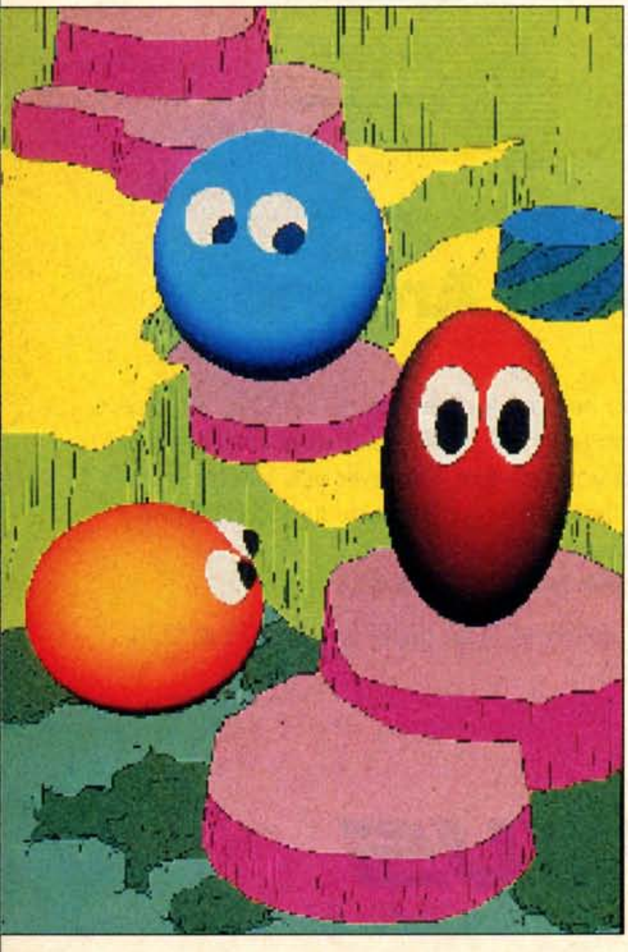
VR Characters Come to Life in the Digital Land of Oz

Can virtual reality join television, cinema, and the written novel as a broadly successful artistic medium? According to Joseph Bates, a Carnegie Mellon University computer scientist fascinated by the dramatic art of stories and storytelling, the answer is yes. Bates is involved in The Oz Project, an attempt to use artistic and artificial intelligence principles to construct believable characters and stories for virtual worlds.

"My goal is to produce technology that will let artists work in VR as a new art form," says Bates. Toward that end, Bates is working to integrate three basic elements of storytelling into virtual reality software—believable characters, rich stories, and a refined art of dramatic presentation.

Besides providing believable characters, explains Bates, an interactive story system must "gently impose a destiny on the human participant [in the drama]. That's what drama means here: The events of the world are organized in a story-like shape. Even though you feel free to do anything you want, there has to be a boundary ... a subtle pressure that pushes things in the direction the artist wants to go."

Initially, Bates has focused on creating VR mini-dramas with simple characters—dramas in which "broadly capable, though perhaps shallow," computer characters collaborate with people to create stories and situations. The first characters he has come up with have been dubbed "Woggles."



Shaped like round, blobby balls with eyes, these interactive, real-time Woggles are imbued with emotions and goal-directed behaviors that allow them to play simple games with the human VR participant. The Woggles express themselves through their movements and by changing color. Among other things, they can dance, sulk, get angry or sad, or play follow the leader. They can also jump up and down, fight, break up fights, console each other, react to situations, and explore their environment. Moreover, the Woggles have been given distinct personalities, and thus are apt to react differently to given situations.

"The characters," says Bates, "have a little bit of a mind, but they are not terribly bright." Rather, they are driven by strong desires and goals which are either frustrated, fulfilled, or manipulated by other characters' behaviors—including the human VR participant's.

One character that inhabits Oz is Lyotard, an interactive cat that has been programmed with certain emotions—hope, fear, happiness, sadness, pride, shame, admiration—as well as attendant behaviors, such as purring, hissing, swatting, and biting. He can even play with a ball or carry a mouse.

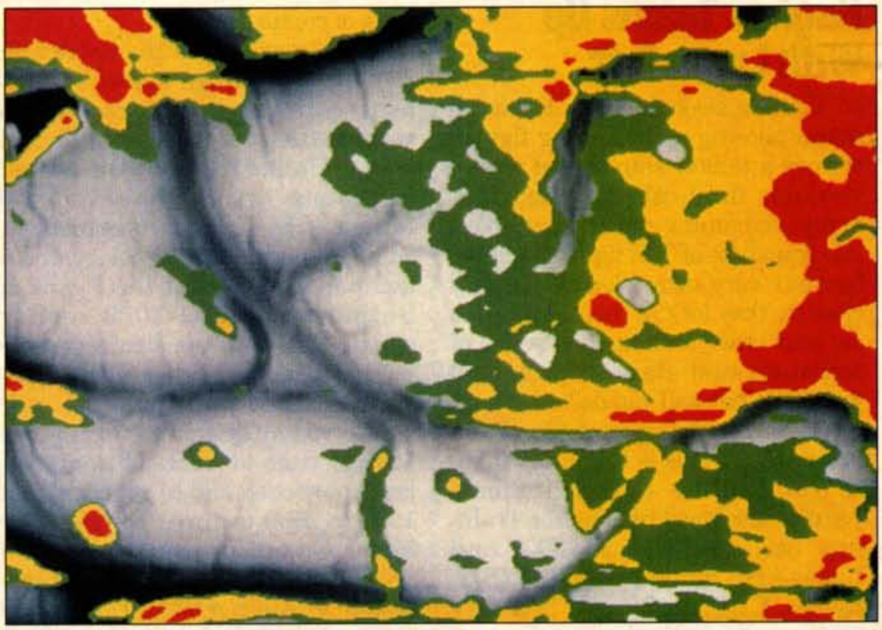
In one session, Lyotard plays with a human participant in a six-room simulated house. As the human "walks" into Lyotard's room, mild dislike turns into mild hatred and fear, followed by a battle between aggression and escape. When "escape" wins, Lyotard jumps off his chair and runs out of the room. Later, however, Lyotard gets hungry, complains by meowing, tries to find food for himself, and ends up having a full meal—thanks to the human participant. When Lyotard eats, his gratitude turns dislike into a neutral attitude; and when the user finally pets Lyotard, he responds favorably by closing his eyes lazily.

To create his characters, which "play" on a Silicon Graphics Indigo workstation, Bates uses a scaled-down, fast-running form of LISP programming (which runs 100 times faster than normal LISP). All told, he can generate about 20 different emotions for the characters from a basic cognitive template. "Emotions are integrated with behavior; emotions affect behavior and behaviors affect emotion," he explains.

While Oz still has a way to go

before it reaches the level of realism that Bates eventually hopes to attain, Bates maintains he is optimistic. Having displayed his Woggles last July at the first Artificial Intelligence-Based Arts Exhibition in San Jose, California, he hopes to demonstrate them at SIGGRAPH this year. A primary goal is to refine the VR drama so it is as convincing to human participants as good theater.

By the mid to late 1990s, Bates predicts that interactive dramas will run readily on PCs or TV sets. "AI-based interactive entertainment software," he says, "may be a key element driving the merger of computing and consumer electronics beyond this decade."—*Arielle Emmett, a freelance writer based in Wallingford, Pennsylvania*



Mapping Out the Human Brain

Until now, scientists have had a limited view of the electrical and optical activities of the human brain. Studies have focused principally on mapping small sections of brain tissue to prevent damage during neurosurgery. In addition, scientists have recorded the electrical activities of single neurons firing to see how neural connections work.

But as new techniques of optical imaging become available, the brain itself is being seen in a whole new light. At the University of Washington, for example, a new technique known as optical imaging (OI) is revealing the activity of whole regions of the brain—including populations of neurons firing simultaneously.

Ultimately, the hope is that this picture of "whole brain" activity may yield valuable scientific and medical information about how the brain actually works. Scientists are already using the technique to identify areas of the brain that cause epilepsy, as well as mapping out the neural structures instrumental in language acquisition and processing.

Optical imaging is actually a combination of non-invasive photography and computer-enhanced mapping of brain cells. The technique takes advantage of the fact that different activities cause brain tissue to absorb or reflect varying amounts of light, explains Daryl Hochman, a visiting UW neuroscientist who has co-developed the imaging technique with neurosurgeons Michael Haglund and George Ojemann.

The changes in light intensity as a person thinks or moves are minute—undetectable to the human eye. Because of that, OI requires the use of a special camera equipped with a silicon detector to do quantitative analysis of light sources. The device has recorded optical activity of exposed brain tissue during neurosurgery. It helps relate light reflection and absorption directly to the intensity of pixels imaged on a computer screen.

"We get a very high-resolution image, with better time resolution than either positron emission tomography (PET scans) or magnetic resonance imaging (MRI)," Hochman says. Spatial resolutions are in microns, instead of the centimeters measured in PET or MRI scans. Moreover, OI is capable of recording brain "events," such as the simultaneous firing of entire neuron populations, in less than a second. Older techniques take several minutes.

No one knows exactly what causes the brain to absorb or reflect light differently depending on activity. The changes in the amount of light reflected from points on the surface of an exposed cortex during epilepsy surgery, for example, are probably caused by chemical reactions, though no one is sure.

Whatever the reason, the technique gives researchers a tool that has already been used successfully to record optical changes in the sensory cortex of the brain during tongue movement as well as parts of the brain controlling language acquisition. This kind of information may ultimately help unravel "the biological basis of language," says Hochman.

In addition, the new technique can be used for many other purposes. For example, the UW research team is already using OI to examine the functions of the brain's mysterious glial cells, which surround neurons and have a membrane potential, but whose exact purpose is still unknown.

"The high degree of detail in these images is the first step on the long road toward learning how the higher functions of the brain are organized," says Dr. Michael Haglund. "Scientifically, we are working toward understanding how the brain works; and medically, it's very important for neurosurgery that we can localize and map out functional and pathological areas of the brain."—*AE*