

ALIVE: Artificial Life Interactive Video Environment

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Description of Artistic Concept

ALIVE is an artificial reality system which was demonstrated for a whole week at the Siggraph-93 conference in Anaheim, California. More than 500 participants used the system and many more saw the system in action. ALIVE is currently set up as a permanent exhibit and experimentation space at the MIT Media Laboratory in Cambridge, Massachusetts.

The majority of virtual reality systems do not represent a very natural or engaging experience to the participant. The first problem is that they require the participant to be "wired up" by means of goggles or gloves. The second problem is that they typically only allow the participant to engage in simple, straightforward interactions. Typically, a user can only navigate through the virtual space (thereby changing what he/she perceives) and sometimes the participant can also perform some simple manipulations on virtual objects.

The goal of the ALIVE system was to provide a very different kind of experience. Inspired by the work of pioneer Myron Krueger, we wanted a participant to be able to interact with a virtual environment in a much more natural, unencumbered way, using familiar gestures that do not require any obtrusive equipment. In addition, we wanted the user to be able to do more than just navigate through the environment or manipulate simple objects. We wanted to demonstrate that in order for a virtual environment to be very engaging, it might not be so important how fancy and fast the graphics are, but rather how meaningful and interesting the interactions can be.

In particular, the goal was to offer a more "emotional" and evocative experience by allowing the participant to interact with animated autonomous agents. These agents have a mind and "will" of their own, but are not indifferent to the actions of the participant. They respond to what the participant does, where he goes, and what kind of gestures and postures he engages in. For example, one of the agents responds to a pointing gesture by going away and showing an unhappy face. When the user beckons it to come back, it returns with a big grin on its face.

In the early days of Artificial Intelligence, the text-based Eliza or "doctor" program was believable enough to make users interact with it as if they were interacting with a real psychiatrist. In a similar way, we wanted to build animated agents that act and react in a "life-like" way (this time in terms of their actions and facial expressions rather than what they say). We hoped that users would find the agents convincing and would be lured into reactions that they normally reserve for real living beings -- reactions such as anger, sadness, happiness, tenderness, and so on. The included video hopefully demonstrates that for many participants, young as well as old, that was actually the case.

Description of Technical Concept

Immersive visual environments allow a user to be embedded into a computer generated environment. With the exception of Myron Krueger's VideoPlace system, experiencing these environments requires the use of gloves, goggles, and/or a helmet, and most likely a wired tether to a computer graphics workstation. The interaction allowed by these systems usually includes only hand gestures and the ability to change viewpoint. The cumbersome nature of the equipment and the limited nature of the interaction has proven to limit the range of applications which have used this type of technology.

Rather than use a goggles-and-gloves approach, we adopt a solution, inspired by Krueger, which allows the user to interact with the virtual environment without any encumbering hardware. We use a single CCD camera to obtain a color image of a person, which we composite into a 3D graphical world. Simple image processing and computer vision techniques are used to extract information about the person, such as his/her 3D location and the position of various body parts. The composite world is projected onto a large video wall in a world-centered reference frame, which faces the user and acts as a type of "magic mirror". The use of 3D as opposed to 2D represents one extension of the ALIVE system with respect to the work of Krueger.

To be useful to untrained users, a system should provide direct and intuitive means of manipulating objects and interacting with the graphical world. The notion of "direct manipulation" is the most straight-forward instance of this concept, in which the positions of objects are directly adjusted by a user. However, when more complicated interactions are considered, a simple static object model is not sufficient. People communicate using a variety of non-direct, contextually dependent signs and gestures. But people do not commonly gesticulate at inanimate objects; communication is a two-way street, which requires a second agent or actor interpreting the gestures.

To have an interface which can utilize semantically-laden and context-dependent gestures, a world containing autonomous agents rather than (or in addition to) inanimate objects is appropriate. Agent-based worlds also provide a richer and more interesting experience than traditional static or physics-based world models. Worlds with intentional and/or expressive agents, i.e. agents that have internal goal states and can optionally express aspects of these states to the user or other agents, have more complicated dynamics than worlds with simple inertial object physics. This leads to environments that are more compelling, and more likely to be used. The emphasis on autonomous agents which have time-varying goals and means of expressing themselves is similar to the work of Joe Bates. It represents another extension of the work of Krueger.

Agents are modeled as self-contained autonomous systems which are embodied in the dynamic world: they sense the world via sensors and can move in and act on the world. Agents have a set of internal needs and motivations, a repertoire of activities which they can perform, a sensory system which allows them to sense their world, a physically-based motor system which allows them to move in the world, and a behavior system which decides in real-time in which activity to engage, so as to meet their internal needs and to take advantage of opportunities presented to them by the world.

A "special" 3D agent is created in the world to represent the user. The position and state of that agent are based on the information computed by the vision system on the basis of the camera image of the user. As such, agents sense the user, employing the same sensors that they use to sense other agents. The special user-agent is not rendered in the final image (instead the live image of the user is composited with the computer graphics).

More information on the technical realization of ALIVE can be found in the enclosed technical paper, which we submitted to Siggraph '94.

Short Bio Pattie Maes

Pattie Maes joined the MIT Media-Laboratory as an Assistant Professor in the fall of 1991. Two years before that, she came to MIT to work as a Visiting Professor at the AI-Laboratory. She obtained her PhD in Artificial Intelligence from the University of Brussels, Belgium in 1987. Her area of expertise is Artificial Intelligence and its application in media and the arts. In particular, she is interested in modeling and building "Autonomous Agents" that interact with participants in virtual animated as well as cyberspace environments. Pattie Maes is the author of several publications, including a book on Meta-Level Architectures and Reflection (North-Holland Publishers) and a book on Designing Autonomous Agents (MIT Press). She has given numerous invited talks, including one at Ars Electronica '93, Imagina '93 and TISEA '93.

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