ALIVE:
An Artificial Life Interactive Video Environment

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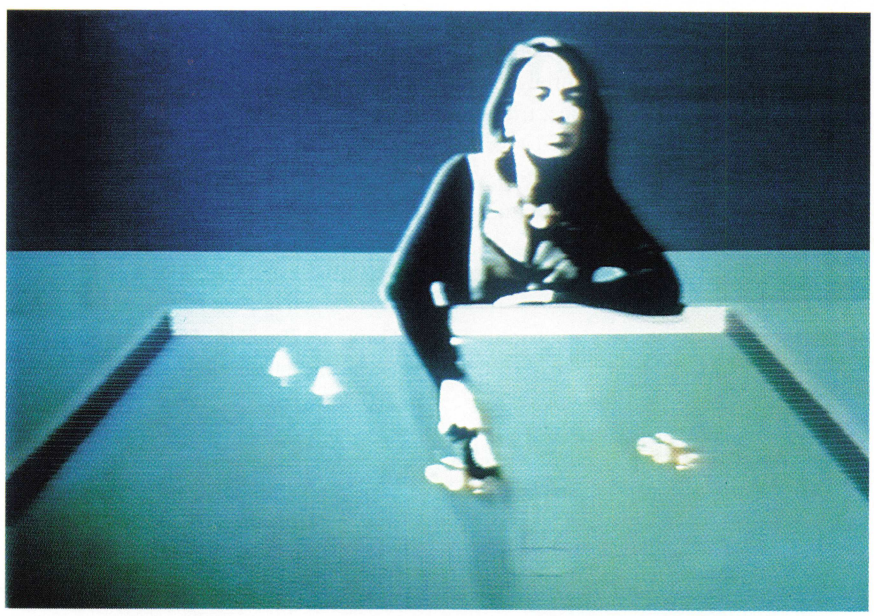
The ALIVE interactive installation brings together the latest technological breakthroughs in vision-based gesture recognition, physical modeling, and behavior-based computer animation. The user experiences a physically based computer graphics environment and is able to interact with the artificial creatures that inhabit this world using simple and natural gestures.

More specifically, chroma-keying technology is used to overlay the image of the user on top of a real-time interactive computer animation. The composited image is displayed on a large screen (10 feet x 10 feet) that faces the user, the resulting effect being that of looking in a "magical mirror." Using natural gestures interpreted by a vision-based pattern recognition system, the user can interact and communicate with the animated creatures in the mirror and as such effect also their behavior.

The goal of the ALIVE system is to demonstrate what recent research achievements in the area of vision-based gesture recognition, modeling autonomous agents or "artificial creatures" and physically based modeling have made possible. The ALIVE system represents one of the first (if not the first) artificial reality systems in which users can interact and communicate with semi-intelligent autonomous agents using natural gestures.

One of the component technologies demonstrated in the ALIVE system is a vision-based algorithm that tracks hands and faces and can recognize the spatio-temporal patterns or gestures a user may perform (Darrell and Pentland, 1993). During a short training phase, several examples of the pattern or gesture are presented. The system automatically builds a view-based representation of the object being tracked (for example, a hand) and uses the resulting search scores over time to store and match gestures. The system relies on correlation search hardware for real-time performance.

The second component technology is a toolkit and set of algorithms that make it possible to create "autonomous goal-seeking agents" by specifying their sensors, motivations, and repertoire of behaviors (Maes, 1991; 1991b; 1993). For example, for the ALIVE creatures, the sensor data include the gestures made by the user and the positions of the user's hands as well as the position and behavior of other creatures in the world. Motivations (or goals) include the desire for creatures to stay close to one another, fear of unknown things/people, and curiosity. Examples of behaviors are: move towards the user, move away from the user, track the user's hand, etc. Given this information, the toolkit produces an agent that autonomously decides what action to take next based on its current sensor data and its motivational state. The model also incorporates a learning algorithm that makes the agent learn from experience and improve its goal-seeking behavior over time.



Hardware

- Sun IPX workstation w/ Cognex Vision Processor
- Silicon Graphics Indigo w/ Elan board
- 10 feet x 10 feet backlit screen
- Color camera (for chroma-keying and gesture recognition)
- Light valve
- Chroma-keying system

Software

- All software is written by the contributors in C and C++. We employ SGI's Inventor and GI software packages.

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The third component technology is ThingWorld, a simulation system that uses modal dynamics for high-performance simulation of non-rigid multibody interactions (Pentland and Williams, 1989; Pentland et.al., 1990; Sclaroff and Pentland, 1991). The version demonstrated here is Distributed ThingWorld (Friedmann and Pentland, 1992), which uses several novel strategies for allocation of processing among networked computers to achieve a nearly linear increase in efficiency as a function of the number of processors.

The relation of the ALIVE installation to the theme of the tomorrow's realities' show is an indirect one. The installation makes users and viewers aware of what is possible with the latest techniques. It does so through an entertaining and evocative interactive demonstration. In addition to the demonstration, informational posters describe the technology used and reflect on its potential impact upon education, the workplace, training, and entertainment.

References

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