Virtual Photography/ PHSCologrames

Most work in virtual reality concerns itself with real-time, immersive interaction. Much attention has been devoted to the development of head-mounted and other displays, but the options for a permanent, hard-copy record of virtual environments are limited to one: PHSCologrames. Developed in 1988 by (Art)^n Laboratory, PHSCologrames are full-color, 3D hard copy images that are created directly from digital 3D imagery. They can be created using nearly any software capable of creating 3D images, such as Alias, Wavefront, or AVS, or from digitized real-world photography. The software is used to generate a number of views, typically 13, although recent work makes it possible to use well over 100 images. Higher numbers of images allow for more depth and special effects, such as limited animation.

(Art)^n's proprietary system interleaves (combines) these views, which are then output on a high-resolution output device. The output is laminated onto the back of a .25-inch-thick piece of Plexiglas. The line screen – a black piece of film containing clear, vertical slits – is laminated to the front of the Plexiglas, where it blocks out 12 of the 13 images at different angles. Because the viewer's eyes are positioned at different angles to the finished PHSCologram, a different image enters each eye, producing the 3D effect.

The line screen has the additional effect of reducing the amount of light transmitted by the image. To counteract this, the PHSCologram is backlit in an ordinary light box. If backlighting is unsuited to the desired application, the line screen can be replaced by a lenticular screen – a series of molded, extruded, or cast vertical lenses that focus light to produce the same effect as the barrier screen. Lenticular screens have several disadvantages, however, most notably the additional expense and time of tooling and manufacture. Line screens, in contrast, may be produced inexpensively on the same output device used for printing the image.

Autostereographs created with line screens and lenticular screens have been seen for nearly a hundred years. They have been made using a variety of optical means, ranging from the elegant to the Byzantine, but they all suffer from the typical inconsistencies of analog processing. PHSCologrames represent a monumental advance because they eliminate the analog steps, replacing them with a carefully controlled computer simulation of the analog process.

(Art)^n's proprietary PHSCologram software can be easily incorporated into a virtual reality system. A 3D graphical icon of a virtual camera would exist in a virtual space. The user would manipulate objects in this space and take pictures with the virtual camera. When the button on the camera is pressed, the computer renders a series of views for the PHSCologram, typically at higher resolution and quality than the virtual environment. These views can then be automatically interleaved and output on an Iris inkjet printer or Kodak Premier full color output device and easily viewed away from the VR workstation.

Further research in this direction includes creation of a simple user interface for a VR environment and development and integration of a PHSCologram server system. Such a server would handle the details of off-line rendering, interleaving, and spooling to the output device, thus increasing throughput and allowing image output without impacting performance for the VR participant.

In 1983, Ellen Sandor, an MFA in sculpture from the School of the Art Institute of Chicago, established (Art)^n Laboratory. The group's name was chosen to indicate the unlimited potential for collaboration among the arts, science, and cutting-edge visual technologies. In the mid-1980's, (Art)^n worked with Dan Sandin and Tom DeFanti at the Electronic Visualization Lab at the University of Illinois at Chicago and Larry Smarr and Donna Cox at the National Center for Supercomputing Applications at the University of Illinois, Urbana-Champaign. In 1987, the results of this collaboration were first shown at Fermilab in Batavia, IL. This collaboration brought about the most significant collection of scientific visualization 3D hard copy. In 1988, Stephan Meyers developed the PHSCologram software. A patent was granted for the PHSCologram process in 1992, and (Art)^n has several new patents pending.

(Art)^n's work has been exhibited widely in international museums and galleries. Recent exhibitions include "From Media to Metaphor: Art About AIDS", a traveling exhibition organized and circulated by Independent Curators Incorporated, and "(Art)^n/Virtual Photography," Rhona Hoffman Gallery, Chicago. The latter show included virtual portraits created in collaboration with Christopher Landreth, Chuck Csuri, SimGraphics, and Colossal Pictures.

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