Making Waves

An Interactive Art/Science Exhibition

October 17– November 16, 1986

V.   Like John Dunn, Thomas A. DeFanti invents systems that make computer graphics available to many people. Unlike Dunn, DeFanti does not want a system that will make still pictures – he wants pictures that move. After an undergraduate degree in mathematics and education from Queens College, DeFanti entered the graduate program in computer and information science at Ohio State University. There he began to create a new computer language called Graphics Symbiosis System (GRASS). GRASS is a vector drawing (or line drawing) graphics system, which its creator describes as "a language designed to bring the immense complexity of a Digital Equipment Corporation PDP-11/45 and a Vector General 3DR Display system within the grasp of artists and educators at Ohio State University." In 1973 DeFanti brought GRASS to Chicago, where he officially joined the faculty of the Department of Electrical Engineering and Computer Science at UICC and carried out his research through the Chemistry Department, which "had the equipment I needed and a big grant to develop computer education techniques to teach to graduate students who could then go out and use the stuff."

At UICC, DeFanti soon teamed up with Dan Sandin, whose IP could colorize black and white images as well as manipulate an image in a number of exotic visual ways. The new partners began to interface the IP with GRASS to create an enticing environment they christened Computer Graphics Habitat (later

renamed the Electronic Visualization Lab). There, users could develop animated teaching or art tapes by combining video and vector computer imagery in real time as they worked. As DeFanti continued to develop GRASS for this new environment, the language became "totally oriented toward real-time generation and control of images" to accommodate Sandin's video system, which (like all television) "cannot easily be slowed down for long and/or time-lapse exposures as can be done with film."

Out of the combined GRASS/IP systems came works which DeFanti and Sandin dubbed "electronic visualizations." Many of these were teaching tapes. But the art-science interface was probably most intense in the series of multi-media public performances called Electronic Visualization Events (EVEs). These were presented at UICC with help from Phil Morton and Robert Snyder (from the video and sound areas of SAIC, respectively). The quartet's pieces, like RYRIL (1976), were performances accompanied by improvised electronic music. A live dancer was simultaneously seen in the performance space and on television monitors, where her image was manipulated in real-time through the IP and interwoven with computer graphics generated by GRASS. Perhaps the most famous interaction of Circle Graphics Habitat with the *outside* world was the use of the facility and GRASS by artist Larry Cuba in 1976 to create the computer graphic segment for the briefing room sequence in *Star Wars*.

The complexity and cost of the hardware needed to run GRASS limited its use to a selected few. Hoping to broaden its accessibility, DeFanti set out to simplify the language. The first result was GRASS3, developed with the help of a postgraduate student, Nola Donato. Then in 1977, Bally Corporation expressed interest in having the language adapted to a home computer they were developing through Dave Nutting Associates. DeFanti worked on his own time (mostly at a cabin in Wisconsin) with Donato and Jay Fenton (a designer of computer games and pinball-machine operating systems). The result was an elegantly simplified version of GRASS known as Zgrass.

Zgrass was designed to be self-teaching and fun for the user. Part of the fun came from the extreme flexibility of the language, which gave the users lots of choice at every step. DeFanti says: "I originally developed Zgrass as a challenge to have a first computer programming language that would be fun. . . . I got a grant to develop educational materials, a set of lessons, which work very well." Unfortunately, the deal with Bally Corporation fell through, and after an agonizing interval and much further research and development, DeFanti became head of a company that made the Datamax UV-1 Graphics Computer to run his Zgrass software.

From the beginning, DeFanti and Sandin used Zgrass for undergraduate teaching. It also became the centerpiece of the unofficial graduate program that arose in the interstices between the art department (represented by Sandin and Guenther Tetz) and DeFanti's home department. Operated as overload teaching and on soft monies, the program limits itself to five new students a year. The program philosophy is a product of joint DeFanti and Sandin cogitation. Says DeFanti: "The program is rather unique in that we teach artists how to survive in a digital/analogue world and we teach engineers aesthetics, then we throw them together." Adds Sandin: "Our philosophy is to give the student a rich and thorough control over the technology the best we can."

Tools in DeFanti's other classes have become compromised as university budgets have shrunk, and governmental support has been increasingly directed at military research. In 1983, he noted: "We simply don't have new equipment unless a manufacturer gives it to us." Nevertheless, for the Elec-

tronic Visualization graduate program, DeFanti says: "In terms of hardware, it is our opinion that sometimes quantity is better than quality." To achieve that density, DeFanti and Sandin scrounge some equipment from industry and buy other needed items with funds from their personal outside consulting fees. And, notes Sandin: "We have quite a few Zgrass machines for students to use. Artists, the way we teach them, actually learn how to program. What supports that is an extremely interactive system that they can work in."

DeFanti's and Sandin's students quickly begin to produce fairly intricate edited animation on video tape. This is made possible by two features unique to Zgrass among micro computer graphic animation systems. First, Zgrass has 16 screens or "pages" of memory. This allows the user to make and store 16 different full-screen images, which can be immediately linked and "played-back" to produce animation. Most systems have a maximum of two such screens. In addition, as Sandin says: "Zgrass speaks standard video [NTSC]. It has a way to get video into it and video out of it, so that VHS machines and editors and Zgrass machines and a black-and-white video camera form a fairly powerful and cheap computer graphics production environment."
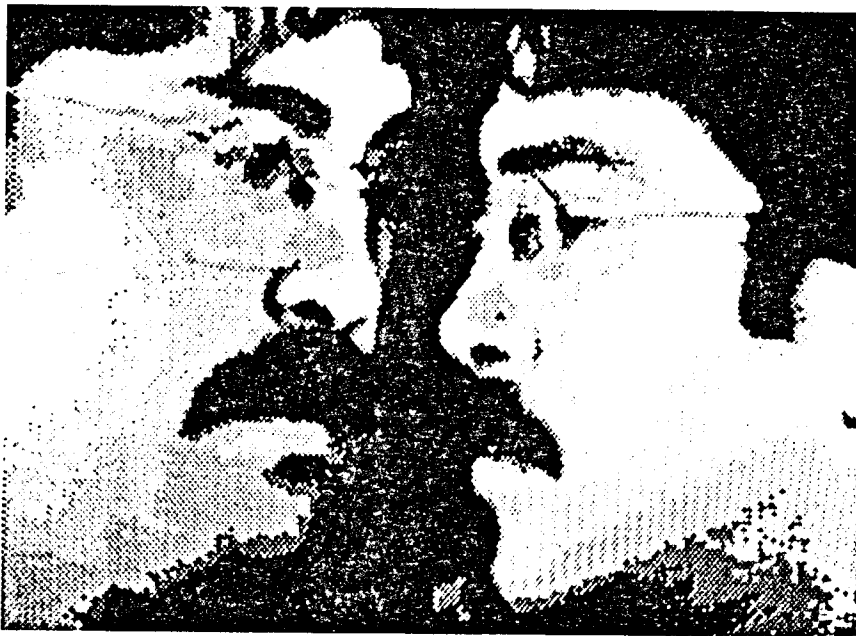
Tom DeFanti, Self-Portrait, computer image camera shot off monitor, 1982.

Zgrass-created pieces have ranged from trips through universes of moving abstract forms to ribald political statements. Some of the most popular work produced by Zgrass users have been interactive games. (Indeed, Sandin regularly teaches a course in game design.) Artist Jane Veeder's Zgrass-based WARPITOUT was the hit of the art exhibition at SIGGRAPH '82 in Boston (the annual meeting of the Special Interest Group in Graphics arm of the Association for Computing Machinery). Players used a joystick and on-screen menus to selectively alter the digitized video image of their own face. A more recent game is ZANIMATION, by student Anthony Sinatra, which allows players to produce cycles of animation by selecting graphic "objects" and determining how these objects change shape and move on the screen.

A network of Electronic Visualization students is gradually spreading through the computer graphic industry, and many students have also gone out to teach. DeFanti and Sandin are busy outside Chicago too, making presentation at conferences and schools, and executing commissions like the library of

vector graphics they created for the live multi-media event, *Mind of the Universe*, performed in November 1979 at the Budoken martial arts theater in Tokyo.

DeFanti was especially visible and influential from 1977 to 1985, when he spent successive four-year terms as Secretary and then Chairman of SIG-GRAPH. During his years as Secretary, his duties included providing the audio-visual support for the annual SIGGRAPH meeting. In 1979, he hired professional AV help — video artist Phil Morton (from the video area at SAIC) and Morton's then-partner, video and computer graphic artist Jane Veeder. Since then the audio-visual parts of SIGGRAPH have become legendary.

In 1980, DeFanti began editing and distributing a juried video magazine of computer graphic work called SIGGRAPH REVIEW, an activity he still annually undertakes. Its collective issues now contain a 23 hour historic sampling of the evolving cutting edge of computer graphics. As SIGGRAPH Chairman, DeFanti supported the mounting of computer art exhibitions at the SIGGRAPH annual meetings, and provided leadership as the annual meeting attendance burgeoned from 300 in 1976 to 27,000 in 1985.

DeFanti stopped working on Zgrass in 1982 and moved to other projects. Currently, he and Sandin are simultaneously developing animation software for the Commodore AMIGA micro computer and for the AT&T TARGA high resolution graphics board. Both have video capabilities which is important to inventors who continue to be committed to creating tools for real-time animation.