6.7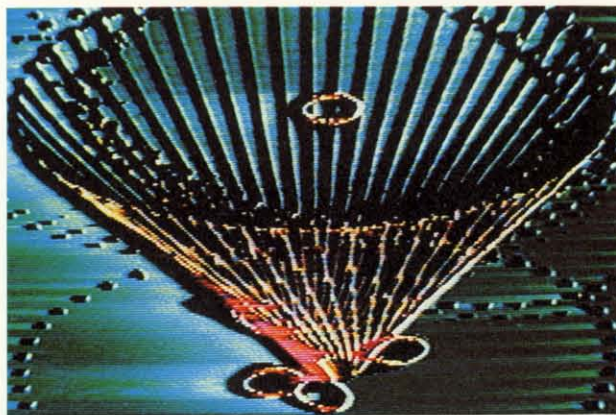: **Frozen Sun Cones**, Joanne Culver. Ektachrome print 18 × 20 inches, PDP 11/45, Sandin Image Processor and Vector General Display. Software: GRASS 1982.

6.8: **Four Faces** by Copper Giloth. Giloth is a leading computer artist with over eight years work in the field. She organizes the SIGGRAPH Art Show.

high-quality monitors. Where does this leave the would-be possessor of computer art?

The implication is that as long as the original image is drawn to a high resolution then enough quality will be transmitted and there is no need to purchase a super computer or even a high-quality monitor (unless you want a giant-sized wall screen). High-resolution images can be piped to the home on cable, beamed from satellite or ground station or purchased on a videodisk and retain acceptable standards.

However the quality of equipment is impor-

tant when generating pictures. Although it is theoretically possible to produce equally great art with a tin whistle as with an 80-piece orchestra, the economic prospects for tin whistle composers are not encouraging. In computer art it is theoretically possible to produce rich artistic statements with the eight colours and aliased lines of a simple home computer, but it is a lot easier to make an impact when you have access to extensive computer memory, almost instantaneous computation and sophisticated input–output devices. Artists such as Mike Marshall,

6.9: **Nude**, Lillian Schwartz and Kenneth Knowlton.

6.9

Fred Polito and now Frank Dietrich are fortunate in having access to custom-built facilities at universities that can afford the latest and most powerful equipment. Computer corporations have also employed artists, who have produced exciting work on successive new generations of mainframe computers.

One of the problems with these systems is that they are mutually incompatible. There has not been as much cross-fertilisation as might have been expected, and artists whose access to equipment is limited have gained little benefit in the form of exposure to techniques they can copy and extend. On less expensive and more widespread systems such as the 'Paintbox' systems described in chapter 8 artists can enter into a dialogue with each other because of the uniformity of the equipment. One key to 'portability', the ability of one person's programs to be used on another person's machine, lies in the use of standard graphics packages such as GKS or GINO-F. These standardize the sort of drawing operations which are available over a wide number of machines, so that methods can be developed to produce interesting effects which can be used on a number of different computers and displays. Standard programming languages also aid portability of programs but few of them were designed with artistic graphics in mind.

Among the programming languages which have attracted significant interest among artists are Kenneth Knowlton's BEFLIX for mosaics, John Whitney Jr's user program at UCLA and especially the GRASS and ZGRASS languages developed by Tom De Fanti in Chicago. De Fanti has been the most energetic promoter of the use of computer graphics by artists; he turned to an early video games system, the Bally Arcade, to make cheap computer images in the late 1970s. Artists working with him, such as Frank Dietrich, did the same and a community of artists developed in Chicago using the Bally system and a dialect of the BASIC language. Dietrich's and Zsuzsa Molnar's work at first resembled Knowlton's BEFLIX patterns but were extended to other low-resolution styles by S. Wenegersh and others.

From there De Fanti advanced to using a computer at Illinois University and his team developed the GRASS system. Images generated by the mainframe are displayed on the screen and filmed with a videocamera. The signal is transmitted to an analogue image processor and displayed again. De Fanti's colleague Don Sandin designed this processor to make real time interactive graphics flexible and accessible on low-cost equipment. The work possible on this system is extremely varied, lending itself to abstract images with woven texture and shimmering ripples of colour.

ZGRASS, developed purely for graphics, is based on a simple microprocessor system and an ordinary television display. It is very easy to learn but creates complex images as in *Snake 1982* produced by Dietrich and Molnar, who have been collaborating in video, computer and performance art for several years. In 1983 Dietrich abandoned ZGRASS and exhibited *Softy 3*, a new departure for him in the smoothness of its surfaces and the sense of depth. This was produced on a VAX 11/750 mainframe with software written in the Fortran language by the artist and David Coons.

At the present state of technology it would be unlikely that *Snake 1982* and *Softy 3* would be produced on the same system. Each combination of hardware and software provides opportunities and constraints, which inevitably means that there are similarities between the creation of different artists on the same system, but in the same way one artist working on different systems will tend to produce different styles using the same artistic vision. Thus Dietrich's work is made less restricting in terms of personal style but more powerfully expansive by the varying media he chooses.

However, versatility does not always depend on using different kinds of hardware. Joanne Culver's *Frozen Sun Cones* is produced using ZGRASS as is Dietrich's *Snake 1982* but the two have no obvious visual similarity. Other artists using the same system, such as Copper Giloth, one of the leading exponents of computer art, show a range of creative expression that is entirely her own. One example of the use of ZGRASS is the extremely witty film *Nuke the Duke*, which uses only simple video game graphics. It was made by Charles Kesler and Jaap Postma of East Carolina University and uses the visual imagery of the amusement arcade. Its subject is the effect of nuclear radiation which may have caused John Wayne ('the Duke') to die of cancer but despite the serious subject, the film has style, zest and engaging humour.

If sharing a common computer language is unusual among artists there is nevertheless a common interest in types of presentation such as multiple images, animation, and interactive art, in which the viewer affects some aspects of the work displayed. Interactive art enables the viewer to explore the range of an artist's vision through the ways the pictures can be changed, and also to recognise the formal structure of a piece by noticing what cannot change. With the advent of interactive videodisks, this kind of art need no longer be restricted to galleries, although the resolution on domestic television sets remains a problem for fast-moving detail.