

**Technology is the People's Friend: Computers,  
Class, and the New Cultural Politics**  
*Richard Wright*

*I am talking to my father when a thought occurs to me.  
"What did you think when I first told you that I wanted to be an  
artist?"*

*"A bit puzzled really. No one else in the family had ever gone into  
that area. We did wonder how you were going to make a living at it. But  
then you moved away from all that when you were at art college."*

*"What do you mean?"*

*"You started out with painting and then you went into computer  
graphics. And now of course you've changed again and you're doing  
computer animation."*

*"Is that different, then?"*

*"Well, it's got a lot more possibilities than what you were doing  
before. It's a new field."*

AS technological media is absorbed into wider and wider areas of society, its demands begin to strain traditional cultural institutions, realigning or exploiting cultural and social groups and threatening to disrupt the established art world and the operation of its aesthetic standards. The working practices of artists are undergoing changes not only in their technical facilitation but also in their relations with other practices and in their function as social constructions. Electronic media and computer processing do not necessarily support the traditional differentials of cultural production and their implicit hierarchies—fine art, independent arts, academic, commercial, activist, community orientated, hobbyist and recreational. Traditional boundaries between media are collapsing as each discipline is computerized and merged with others to

create new forms. The tendency to replace the physical basis of media such as photography, cinema, graphics, and painting by reduction to digital information has undermined a large part of their artistic identity. A frame of film can now be digitized, retouched, or recomposed as if it were a painting. A line of text in an illustration program can be placed in an "envelope" and manipulated as though it were a wave form in a sound synthesizer. And a file of dry, abstract numerical data can be interpreted as a kaleidoscope of pulsating colors.

Driven by the notion of computer manufacturers that they are fulfilling an artistic desire for unlimited formal innovation, little structural or historical basis is offered for the variety of means of expression made available by the formal freedom enjoyed by computer processing. There is no indigenous studio practice or aesthetic linked to any particular arts practice, form, or genre—they all meet together as interchangeable data entities in the digital environment. A software package such as Adobe *Photoshop* can be used by fine artists, commercial designers, illustrators, and photographers as a complete studio system in itself. The artistic specialists and experts that previously dominated each of their separate disciplines now find themselves working at the same machines as a wide range of "users," and their skills and tools are now encoded down to a list of menu options. The relevance of Walter Benjamin's famous statements about mass reproduction dispelling the aura of the privileged object can now be extended to the aura of the means of production and to the reproduction (or more accurately the simulation) of the means of production.

We can see about us many ways in which institutional bodies and commercial computer vendors have reacted to the situation, playing one social class off against another in order to define and secure a new market or to aestheticize new media to reestablish cultural demarcations and art-world values. This has led to phenomena such as the emergence of alternative exhibition circuits based around academic and industrial collaborations, each one struggling to identify with whatever artistic ideology looks set to rise to dominance. Credit for the democratization of media, global access to culture, and the unification of art and science have been laid at the door of digital media and telecommunications. But the differing backgrounds and interests of the forces at work in these areas—commercial, institutional, academic and artistic—can lead to conflicts of context with bizarre results. In this sense digital media

provides a highly charged area in which the pluralist and multivalent approaches that were associated with the rise of poststructuralist theory can find direct (almost trivialized) application. New opportunities for cultural alliances and initiatives come hand in hand with confusion and exploitative colonization as "technoculture" creates a new landscape into which cultural strategies can be mapped.

This essay divides the cultural sociological study of this emergent technoculture into three main motions. Firstly, democratization—the increased access (both economic and social) to production provided by new technologically based means, as against the centralization of production by its dependence on and consumption of the same technology. Secondly, mobility—electronic media operates as a space for interdisciplinary encounters. Here, the emergence of an expanded field of players is caused by the introduction of new extracultural forces such as scientists, business people, and educationalists who discover they have overlapping interests in the application of technology to media and the arts. Finally, aestheticization—mainly a recuperative force concerned with establishing and promoting standards of excellence, either by reinforcing old hegemonies or by constructing new ones around emerging power structures, but it can also function as the search for fresh languages and means of expression, and ultimately return us to notions of cultural identity and empowerment. This essay hopes to provide a series of snapshots of contemporary electronic arts practice that are articulated by these three themes, and to use them to confront and provoke.

The three highly contested areas just mentioned are themselves grounded in a history of interclass conflicts, oppositions, and relations. The same means of production is now not only used by people working in different artistic disciplines, but by people working in and for different social classes and needs. It is not, as many try to suggest, as trivial an argument as trying to describe a pencil as a great leveler because everyone uses one to draw with. Electronic media is not just a random collection of tools for making pictures, but a system of interlocking artistic, technological, and commercial interests that are coming together in new cultural and social formations. It has now become impossible for cultural institutions to ignore the pressure being applied by previously marginalized groups and formations as they exert their newfound economic influence, made possible in part by the commercial traffic in technological

media. In turn, the potential appears for a space to be created where a wide range of cultural interests can develop, gain confidence, and begin to operate.

### **Democratization**

*We are having a computer graphics open house day at our college and I am demonstrating some software to a potential student. He is working in an office job at the moment and has no formal art and design background but is interested in our short course in computer animation. I prepare myself for the question he will inevitably ask.*

*"So if I take your course will I be able to get a job in computer animation?"*

*"This course is an introduction to computer animation and covers the basic techniques, and gives you some hands-on experience of a typical animation system. We also teach you the basic principles of animation as a starting point for any further studies"*

*"I don't mean to be rude, but that doesn't answer the question."*

*"O.K., its an introductory course—we can't give you experience with the kind of studio you'd find in a facilities house, but we give you a grounding in the basic techniques. People can spend years studying animation or computers. It's up to you how far you take the skills you learn and to work towards putting together a portfolio. Does that answer your question?"*

*"No."*

### **Migration**

*I am at a major computer graphics conference and have been looking at some exhibits in a special section dedicated to new designs and applications of interactive interfaces. There is one particularly entertaining exhibit that catches my attention and appears to have been produced by some scientists working for a well-known computer manufacturer. I decide to see if I can get some background information on this installation.*

*"Do you have any documentation on this installation?" I ask a young lady. "Oh, no," she replies, "it's not a commercial product. We're artists." I enquire further, pointing out the connection with the computer company that seems to be sponsoring their work. "No. It's not research. We're really just artists that happen to be working at this company." "Is there perhaps an artist's statement available then?" I*

*persist. "Er, no, we don't have anything like that either—but perhaps that would be a good idea though...."*

### **Aestheticization**

*I have received an invitation to participate in an interactive networking event planned for a number of up-and-coming art shows and cultural festivals. The theme is described as an "international creative exchange through advanced technology" in which artists from different countries will each contribute a panel to a kind of "electronic quilt." Visitors to the event will also be able to electronically paint some sections of a video wall reserved for that purpose. The accompanying leaflet points out the curator's "long-term commitment to making the technology available to artists everywhere." What are the criteria for artists wishing to participate? For the "world-class artists" that are selected, "selection is on the basis of their work in the fine arts. Computer experience is desirable and they should be recognized in their own country." But—"those with limited experience in utilizing the electronic art medium will be trained...." Send a resume.*

### **Bullshit**

*A friend who illustrates and produces his own highly contentious style of comic books is telling me how to get a bank loan. "I take in all my computer work and spread it out on the bank manager's desk and start telling him about how it's all done. He doesn't understand a word but just nods and says, 'Mmm ... computer graphics . . . yes . . .'" Then he asks me how much I want."*

### **Mobility: From Big Science to Big Art, and Back**

*"I use a computer... because I hope that the assistance of this tool will permit me to go beyond the bounds of learning, cultural heritage, environment—in short, of the social thing, which we must consider to be our second nature . . . to produce combinations of forms never seen before, either in nature, or in museums, to create unimaginable images." Vera Molnar, computer artist, 1979. Quoted in PAGE, the Computer Arts Society Quarterly, 1980.*

*"In morphogenetic research, we have striven to apply all of our knowledge both technical and artistic, to create more insightful images, and*

*to develop more advanced algorithms for the creation of sensual objects. Thus, it is hoped, the union of analytic theory and aesthetic sensibility, that is, the fusion of art and science, can be achieved."* Yoichiro Kawaguchi, IEEE Computer Graphics and Applications Journal, April 1985.

*"Leaving our protected ivory tower for this first exhibition proved a unique learning experience for us. We found ourselves confronted with challenges very different from those which we were accustomed to in our professional lives. This was particularly true for the catalogue in which the scientific background of the pictures was to be explained to the general public."* Hans Peitgen and Peter Richter, The Beauty of Fractals, 1986.

Computer graphics provides an example of a field with a history of pioneers who crossed over between the disciplines of computer science, engineering, mathematics, art, and design. It is also the case that the mobility between workers in the academic, industrial, commercial, and entertainment sectors has long been accepted as a beneficial transference of knowledge and skills. Many of the most successful production houses were founded by artists, who first developed the commercial potential of digital imaging after working in collaboration with computer scientists. Much of the impetus for art and design applications of computing has come from an academic research base at educational institutions—from a mixture of artists, designers, architects, mathematicians, engineers and other scientists. Behind this situation is a unique intermingling of the needs and interests of science, commerce, and art.

Computation and graphical interfaces have become integral to the practice of contemporary science over the last few decades. As the ambitions of science to represent more sophisticated and multivariate phenomena have increased, so the problem of monitoring these systems in an efficient and accessible way has become more urgent. Computer simulations of complex physical processes have become an important strategy in trying to understand the conditions necessary for certain phenomena to arise.

High-bandwidth data acquisition techniques have also been developed, allowing astrophysicists to record huge amounts of information for later scientific analysis. Both these methods typically produce many millions of raw numbers that threaten to bury the research scientists before they can convert them into an under-

standable form. The only technique efficient enough to display vast quantities of information in an easily assimilable form is to turn them into pictures. Relationships between elements are quickly picked out by the discriminating eye, color gradients can be apprehended, and signs of movement detected. This pressing into service of the intuitive faculties finds easy acceptance in today's laboratory, where the principles of scientific objectivity, truth, and the pursuit of knowledge have become obscured by the need to *perform*—to provide workable solutions to practical problems, and to provide technological innovation and commercial stimulus rather than abstract explanation of the mysteries of nature.'

A feature of this new methodological license has been the appearance of "interdisciplinary teams" of researchers. Groups consisting of physicists and mathematicians are joined by more technically oriented computer scientists and engineers, and then by experts in perceptual psychology and cognitive studies, and artists. Although scientists had worked with artists before on rare occasions, such as during the Art and Technology projects of the 1960s, more recently the impetus has come from the scientists themselves. As well as invitations to artists to assist in visualization projects, scientists have become more and more seduced by the results of their own experiments, and artists have been looking with interest at the imagery trickling out of computer labs. The mid-eighties saw the increased availability of high-resolution color graphics in scientific research centers, and with it came the phenomenon of "scientific" forms of "art" almost completely autonomous of mainstream culture. The most well-known examples are Chaos Art and Fractal Art, forms that by the late eighties had received widespread attention from artists and critics.

One of the first and most publicized of these manifestations was "Map Art," originating from a traveling exhibition of the work of a group of mathematicians and physicists at the University of Bremen. They had been generating images of fractal Mandelbrot sets for their work on dynamical systems until sometime after 1981 when "the idea for an exhibition came up." They were invited by a bank in Bremen to exhibit their work to the public and to produce an illustrated catalog. The success of this show led quickly to two more by the end of 1984 and culminated with their work being added to the cultural program of the Goethe Institute. What was most interesting was the pressure put on the scientists to account for their work in the catalog in cultural and ideological terms, an account that they had not

expected would be required from such an audience and at variance with the conception of art that they, as typical scientists, possessed. "What had been quite simply fun in the context of our scientific work suddenly became the topic of very serious discussions. The viewers demanded an explanation of that context and wanted to know its importance."<sup>4</sup> Peitgen and Richter go on to explain the effort it took to ease themselves out of the relatively narrow frame of reference in which they worked and to try to bridge the gap in mind-sets between mathematicians and the wider public. In fact, on reading their description, one might be forgiven for getting the impression that these scientists had been leading some kind of alienated monastic existence before their reintroduction into the real world through their participation in art.

As media interest in these swirling masses of color and crystalline structures increased, a still unresolved ideological tension emerged over the function of these images and the status of their producers. If the images that scientists were now using in their research were attractive enough, could they be called art? Were their properties as hypothetical models of natural phenomena (still hotly debated within the scientific community itself) relevant to their "meaning" as artworks? And really, could someone who had never been to art college and had never heard of contemporary French philosophers command the authority to hold a major international touring exhibition of their pictures?

By 1989 fractals and chaos theory formed part of the subject matter of an art show at the New Museum of Contemporary Art in New York. The theme of the show *Strange Attractors : Signs of Chaos* was the relation between order and randomness, logic and the irrational, in the context of the new scientific ideas that were becoming popularized through their attractive graphical imagery. The work exhibited was a mixture of photographs, installations, and sculptures by artists that addressed chaos and served to contextualize the scientific discourse that was represented by just a few images of strange attractors and fractal landscapes produced by scientists. A passage in the catalog by the curator, Laura Trippi, is instructive in its indication of a contemporary attitude of the art world towards this new extracultural force. "In 1986-7, James Welling [exhibiting artist] produced a series of 'circle paintings' that bear a striking resemblance to the 'sphere fractals' of Mandelbrot, among the least obviously 'fractional' of fractal images, printed in black and white in the book (*The Fractal Geometry of Nature* ). In Welling's paintings,

the massing shapes come across at once as vaguely ominous and profoundly pop, suggestive in this context of a deadpan commentary on the "promiscuity" of fractal graphics (even, more generally, on that of simulation), the near-contagion of their allure."<sup>5</sup> Although Trippi had based the show on new scientific concepts in nonlinear systems, it still seemed necessary to criticize the scientific graphics for their vague aesthetic threat.

One of the most bizarre features of this "mathematical art form" is its ability to almost completely negate the practice of aesthetic creativity and craftsmanship. To produce a hypnotic fractal vision of the Mandelbrot set for example, one merely types in the computer program from a book or magazine—about a dozen lines—and enters about four numbers (almost at random within a specified range), to define which part of the image to "zoom in" to. To animate the result is even more simple j u s t load the image into a basic paint program and "color cycle" it (a simple electronic paint function) for a surprisingly authentic-looking psychedelic effect. Although the diversity of imagery that can be found in the Mandelbrot set begins to pale after a few days exploration, there is now a vast array of mathematical objects to chose from: fractals, graftals, cellular automata, bifurcation diagrams, chaotic systems, and iterative mappings. Catalogs of mathematical and scientific software are full of programs with names like "Fractal Explorer" used to generate, explore and save all kinds of fractal exotica. It takes no more than a training in high school mathematics to begin writing one's own functions based on the standard forms of equations. Most importantly, mathematical art like this introduces a way of making imagery in a formal way without any visual understanding of images themselves. Highly decorative and intricately structured forms are designed numerically using the language of the scientist, and performed at the keyboard, not at the easel. This presents us with the prospect of an aesthetic developing from a nonaesthetic practice and divorced from the usual cultural sensibilities.

The modernist promotion of individualism as creativity, subjectivity, and originality became part and parcel of a popular ideology of art that has been used to support everything from psychoanalysis to capitalist entrepreneurship. It is this construction of the integrity of "the subjective" that informs most popular discourse about art, especially outside artistic circles. As the pursuit of pure science has come under political attack from the New Right, there is a real sense in which the arts have become a notional haven for scientists

wishing to pursue idealistic goals in their work. For many scientists, notions of artistic integrity or autonomy have provided a space in which they can escape from the commercial pressures of modern scientific research and pursue their more personal interests in an atmosphere of refined and enlightened tolerance. Research institutions have sometimes recognized the value of supporting activities if they are immediately suited to media coverage and can be directly exploited for very considerable publicity—quite apart from the projects that are specifically for application in the entertainment industry. It is not so much the case that research of the purest and most speculative kind is in the process of migrating to the artistic arena. Rather, those seeking a kind of open-ended research and having a comparatively escapist or dilettante attitude seem most attracted to this position. Art seems to provide a way for the "blue sky" research centers to give a certain direction to their work and attract publicity; perhaps it provides a way to introduce an element of play into their methods not normally considered proper. At the same time, art has become a way for scientists wishing to follow an exploratory line of enquiry not directly related to marketable outcomes to avoid committing themselves to any rigorous program, and from defining the exact function that their most speculative work fulfills in a wider social, commercial, or even contemporary cultural context. Questions even in the most general terms related to the purpose behind a project can be deflected by stating "It's just art . . ." followed by a respectful silence.

If "pure" science is retreating into "purer" art (or a rarefied modernist conception of it), it can also be observed that over the last decade artists under attack from similar reactionary forces are seeking legitimation by identifying with science and technology. In the past, government funding bodies in Britain such as the Science and Engineering Research Council (SERC), which validates Ph.D. research programs, has twisted itself into knots when considering proposals that contain a strong art and design component. During the eighties the massive investment of technology in the media industry spawned a demand for research that stimulated a new response in the academic research sector. Art and Design faculties found their postgraduate students applying for doctorates to do work in computer imagery and animation, often prompted by the hope of lucrative placements in commercial production houses. After receiving an increasing number of research projects that would result in nothing more conclusive than a computer program to produce a

realistic-looking forest of trees or a cloud, SERC accepted in principle the concept of scientific research in art and design media, deciding that at the very least a Ph.D. project must result in some kind of formal written documentation to support an otherwise practical component.

In 1990 the Roith Report Committee published their policy document, entitled *Research in the PCFC (Polytechnic Central Funding Committee) Sector*. The new categories of research in academic institutions were laid out and described, covering all areas from basic or pure research, to strategic research and applied research, to scholarship and creative work. Though not concerned with any specific level of research, the Roith Report tried to allow for such areas as art and design with its category of "creative work," which it described as "the invention and generating of ideas, images and artifacts including design. Usually applied to the pursuit of knowledge in the arts." The ground is thus prepared for the formal inclusion of a far wider range of academically funded activities than before. Because most British art colleges had been merged with polytechnics since the 1960s and were upgraded to university status, a large proportion of artists may find material attractions in considering their next project as a piece of "research." Likewise, with the continuing universal disdain for pure research that has demoralized so much of the scientific community, those that have stayed to fight have sometimes found allies in unexpected quarters when moving into the expanding field of media technology. We can perhaps look forward to interesting discussions at research committee meetings between heads of Physics, Architecture, and Art and Design as they try to agree on research priorities and common resources. They may need to find a common ground in order to secure these new sources of funding. Quite frequently that common ground is computer imaging and media technology.

By rallying around the flag of technology, then, artists and scientists have found new ways to legitimate their aspirations, and at the same time provide implicit channels of access into each other's disciplines. It is this effect of bringing the world of cultural production to wider groups that we will now probe further.

## **Democratization**

*"The Only Limit is Your Imagination"*

—*W Industries promotion, 1991*  
(*simulator and VR games manufacturer*)

The phrases "democratization of media," "empowerment of the individual," and "access to the means of production" have functioned as everything from popular aesthetics, to artistic manifestos and cultural hypotheses, to advertising slogans. For the Mac it was the "user friendly" graphical interface, for the IBM PC it was a stream of references to the great Renaissance "universal man" of art and science, for the Commodore Amiga it was the cheap and cheerful video studio in a box. For computer manufacturers the short-term aim of popular computing was apparently to provide access to processors not previously available to the mass user. But there are two distinct senses in which the idea of democratization as access can be used: that of physical and economic access to production, and that of cultural and social access to production. Technological media introduce important new features into both of these, as well as revealing new relations between the two.

The strategy behind the commercial development of mass-user electronic media has been to focus on the individual as the ideal producer/consumer. This has produced low-cost general purpose computers that can be bought by people with very diverse needs—towards art and design or otherwise—and a software base of specialized application packages and a range of peripherals: printers, styluses, tablets, storage media. By making a selection of software and hardware products, a user can build a computer workstation to suit his or her production needs. This has become known as the "desktop production" revolution, comprising desktop publishing, desktop CAD, and now multimedia and desktop video. Applications software exists to supply the technical functions for most design disciplines and processes: drawing, illustration, 3-D design, typography, layout, presentation graphics, and so on. Each of these areas of expertise is *encoded* into the user's workstation as a piece of software and a set of tutorial manuals. Whereas before if you needed some airbrushing done on your artwork you would have had to hire a specialist airbrush artist to do the work, it is now just another option in the menu lists of a digital paint system. The whole history of technical skills in design is sitting in front of you at your terminal. You sit at the desktop, click the mouse, and you *access*.

In this new studio environment the interactions between people and materials become narrowed down and focused onto the VDU screen on the table. This *desktop fetish* results in a centralization of the studio practice in the single lone user. Whereas before a design job would have needed a team of art directors, visualizers, illustra-

tors, graphic designers, typographers, and pasteup people, now it can be tackled by one person without getting up out of their chair. Buy a Mac and become a design company.

What emerges is an increased number of freelancers, all offering a wide range of design services. (The question of whether the skills provided are of a consistent quality across so many different areas is debatable.) There is less need for production to be based around groups of specialists rather than individuals, and this may tend to diminish the social interaction that stimulates people in such a community of workers. In some ways this is analogous to the development of multitrack recording, which allowed one musician to perform all the instruments in a piece. This does not necessarily mean an inevitable decline in cultural production as a social process, but computer marketing is always in terms of the primacy of the individual consumer; computer media strategies stress *individual* rather than *social* access.

In larger design studios, problems have been caused by the introduction of design technologies for the same reason. For the first time in history, designers are using one tool to develop every phase of a project, blurring the distinction between tasks and making job demarcations difficult to define. Normally, the process of designing is a hierarchical one. After the client's initial brief to the art director or creative director, the basic design is passed to a team of designers and their assistants. This team may include illustrators, copywriters, typographers, and photographers. After the presentation has been approved by the client, the production artists and assistants prepare the final artwork for the printer. With the introduction of computers, the boundaries between these different areas have become unclear. Designers have found that they could have too much control over a project; taking on too many ancillary technical tasks that should have been done by specialists. In a field of semiautomated production, technical knowledge can be critical, and one mistake can easily lead to wasted time and unusable work. This has resulted in some managers imposing severe restrictions on exactly who is allowed access to what machines and software. (In some educational institutions, as well, design students are not allowed to use a computer until they can show they have a finished design to work from.) But for other design companies this is seen as throwing away the creative potential of exposing designers and artists to new techniques. Insisting that designers work "away from the terminal" must discourage the playing around with technology that is often seen as

essential to the development of new ideas. An alternative strategy is developing that combines the specialist knowledge of a designer's main area of work with a general knowledge of other areas, all supported by increased communication between different members of the team. As larger studios increase their amount of computer equipment, firms will be able to divide the responsibilities for projects as they used to, but people's roles will still overlap more than they did and creative teams and production teams will need to know more about each other's duties and technologies.

Previously, the design process was thought of as a linear chain from designer down to printer. It was hoped that the computer would simply speed things up a bit, remove a few links from the chain, and improve communications. Now, with a new common ground between specialists, design organization is seen as more of a *heterarchy* than a *hierarchy*, with shared responsibilities for the work between different colleagues. The specialist areas of activity still exist, but no longer as isolated or privileged. What we really see here is how new technology that is applied to previous methods of organization highlights the limitations of those systems and prompts a new way of tackling the problem. For both the independent designer and the company employee, electronic design can both broaden the creative opportunities of each individual artist and reveal the necessity of his or her interdependence with other workers.

The emergence of people from scientific and technical back-grounds as a necessary part of the cultural workforce has been a prominent feature of the electronic media industries. "Animators," "technical directors," and "paintbox operators" in studios and facilities houses are often graduates of computer science and engineering courses who have been hired for their familiarity with computing principles. Production houses also typically employ a group of technical experts expanded to include programmers, system managers, network technicians, and hardware and software engineers. The gap between the work of a technician and a graphic designer or model builder has become less distinct. The problems involved, for example, in inputting 3-D data into a computer are frequently of a rather technical nature, or may simply demand more of a superhuman level of patience than a surfeit of creative insight. The difficulties that occur when trying to digitize an object such as a hand can more often be appreciated by someone with an understanding of sampling theory, mathematical surface modeling, and 3-D computer inter-faces than someone who knows how to animate a bouncing ball. (It

could also be argued that the tedious repetitive tasks that accompany much production work can be more easily passed on to some-one from a nonartistic background who is grateful for the chance to enter the glamorous world of media at however low a level.) There is, therefore, a large and integral area in media production that is of a highly technical character, requiring specialist skills (or temperaments) usually beyond the scope of art and design graduates and resulting in an unusually rich diversification of peoples and back-grounds. Indeed, for an intensely pressured production company the prime requirement of a new colleague is that they can communicate well with others and work with them as a team.

The realignments that result when a technology is introduced into a cultural practice are often discussed with a historical reference to the development of photography. There are many fundamental differences between photography and computer media, the most important being that the computer is a nonspecific technology. Unlike a camera and a collection of darkroom equipment, the computer is a generic technology that has been implemented across a wide range of art and design disciplines, and across an even wider range of applications throughout the whole of society. The crucial similarity is the *industrialization* and *commercialization* that occur when a sphere of cultural production is "technologized." When production becomes dependent upon a technology, let's say a camera and film, it becomes dependent upon an industrial and economic structure in order to support itself. Photography needs an industry to make its cameras and process its films. To make this feasible in a modern capitalist economy, the operation needs to have a commercial rationale behind it. There is a marketing strategy that identifies the potential users and of the product and their desires, and a program of research and development that meets these needs and provides the technical innovations to stimulate new ones. On top of this are the forces that determine business plans, the need to diversify and expand markets, to compete in terms of technology, and to identify its applications to optimize returns. These commercial interests have targeted many different classes and social groups in an effort to generate a mass market of users of art and design software.

The technical nature of computer media as applied to the art and design process also provides new channels of access and exposure for classes of people who cannot take the traditional routes. There are wider social groups of people who are trained in neither arts nor science but who find the technical aspect of electronic

media appealing and an incentive to get involved. For many people it is more important that an image has been generated digitally than that it is fine art, research, or advertising. In this way social access to production is stimulated and interest in culture that has a technological component is encouraged. For some social groups technology can be a neutral ground in which new activities can be sampled, isolated from their historical baggage.

The image-making technology of photography proved to be very amenable to commercialization, and the business strategy employed was that of the mass cultural—the social construction of photography as "the world's most popular hobby." Photography as a cultural form bypasses the traditional routes of access through institutions and class; it has a vast supporting structure of popular magazines, amateur groups, conventions and exhibitions, often functioning at a local level; and it compensates for the level of skill and dexterity needed for drawing by a partly technical knowledge of lighting conditions, filters, and shutter speeds. But what are the forms of cultural practice it has motivated? Photography has a central role in commercial art—in advertising, design, and graphics; it has a function in documentation, in photojournalism, as judicial evidence. It figures in the media, often providing the pivot for magazines and pictorial publications. It has certainly been used to rein-force the identity of commercial and academic culture, but what of the realm of the "popular"—what is commonly referred to as the realm of the amateur photographer? There is no doubt that photography has become a means of mass cultural expression, but the forms it has taken seem to promote cultural hegemony as much as to sidestep it. The common genres of amateur photography are wellknown—the holiday snapshot, the births, marriages, and deaths that have become photographic rituals enshrined in the family album, the new home, the kids in the paddling pool, the graduation ceremony. The popular becomes conflated with the personal, a petrified subjectivity beyond the reach of anyone outside the family circle. Attempts to expand the genre of the popular (through the contradictory strategy of state arts support) have resulted in the end-less projects of social documentary photography—old people sitting in a park, shopkeepers laughing, and mothers pushing prams—all finally ending in a poorly attended exhibition of "community art" in a municipal gallery space. Problems of developing the cultural identity of the community, from the confines of the familial into the social realm and the shared experience, are coupled with problems

of consumption and distribution. It is at this point that democratization as the promotion of a popular culture demands a different aesthetic and social program as well as an economic one.

Although the manufacturers are eager to sell digital media to as wide a selection of social groups as possible, they do not normally consider it necessary to address the issue of widening the range of what these new users can actually do with their packages beyond applications that are part of the intentional design of the package. Software packages are increasingly targeted at specific user and professional groups as primary consumers, new forms of cultural production are difficult to imagine and risky to explore (note the continual confusion over what the nature of the "multimedia industry" is, or even more problematic, the "virtual reality industry"). But occasionally efforts are made to place an electronic medium some-where in the cultural hierarchy. For example, the most obvious strategy for Quantel—the manufacturers of the electronic paintbox and digital video effects suites used in all the top facilities houses—was to give its products the kind of high-art prestige fitting to their place in expensive high-end professional video production. In the BBC TV series *Painting with Light*, transmitted in 1987, it invited a selection of famous painters to produce a work on the company's paintbox system (with which the painters had no previous experience) while being filmed. Apart from the blatant pitch for "serious" cultural superiority, the result was to denigrate the status of an independent "computer artist" practice in favor of a more traditional fine art discipline. And as critic Philip Hayward later wrote, "The irony of involving traditional fine artists such as painters with the medium of television is of course that in changing the context of their work (from the easel to the screen), the very specific qualities of their traditional practice coveted by the media (their precise composition and the *aura* of the original) are of course dispensed with."<sup>6</sup>

On other occasions commercial forces have taken quite different approaches, such as JVC's sponsorship of the Tokyo Video Festival. Since 1978, the festival's aim has been explicitly to promote the use of video making among as wide a group of the general public ("our customers") as possible, inviting both amateurs and professionals to participate, and frequently awarding the top prizes to the former. The range of work covers everything from video diaries, documentaries, and campaign work to back-garden features and lyrical abstraction. From the start, the intentions of the organizers seemed to be to present video as a new medium distinct from either film or

TV and driven by a logic of general technological proliferation. Despite the rush to promote "video culture," the festival catalog presents anything but the united front expected in the usual corporate showcase. In the judges' comments, quaint terms like "citizen's video" are tempered with the desire to avoid categorization based on the abilities of participants and to avoid efforts to define the nature of the video medium. The whole catalog is peppered with disagreements over the merits of the prizewinners and various calls for more original or more "expressive" work—inconceivable in the manufactured consensus of the corporate art events that we are commonly subjected to. Sometimes the differences in cultural politics from aestheticization to democratization can be reflected in business strategies, revealing how the interests of commercial and cultural forces can either coincide or contrast.

A quest to locate a popular electronic media practice might lead us to speculate on the possibility of an "amateur computer artist," operating in a similar fashion to the amateur "Sunday painter." Such a creature would be defined by the reflected glory of another practice of higher cultural status, that of the professional fine art painter. But if we look around at some well-known applications of media technology to popular arts genres, we see anything but a desire to emu-late the practice of high culture in a computer-based form. For one thing, there is no properly identified "high-culture" for "computer art," or at least not one that has become entrenched in the main-stream. What we do see is a continuation of forms of popular culture extended in various ways—like digital sampling and recording in music or forms of independent publishing stimulated by desktop technologies. Otherwise, completely novel forms, (in terms of their social functioning) seem to have arisen—like networking as a means of distribution or game playing as a form of interactive fantasy or fiction.

A relation between high and low art is still articulated at the digital level, though in rather bizarre terms. It is now possible to buy a modest software package that applies filters to digital images to give them the appearance of having been created by an artist's hand. One called *Gallery Effects* by Aldus includes sixteen "master effects" to turn scanned photographs into "Charcoal, Watercolor, Fresco, Film Grain," and many others. The software is advertised as "*Every-thing you need to transform images into art.*" High art has been brought into the domain of computer media, but now it is merely a style—a "*sophisticated professional-looking artistic effect.*" Although

this software only changes the surface finish or texture of an already completed picture, other software products exist that assist in higher-level problems such as composition. These packages are mainly aimed at business users, who use them in the production of information graphics, but there is no reason why this strategy could not be gradually extended, using artificial intelligence techniques to automate all sorts of aspects of the art and design process.

This kind of phenomena reveals a very ambiguous attitude to high culture. On the one hand, software companies accept it as a desirable standard to be achieved in as painless a way as possible. On the other hand, it is seen as just a mechanized process, drained of its "aura" and reduced to a commodity. As a way of promoting cultural activity it can also be seen as taking the path of least resistance, resulting in a negation of original expression by its simulation of traditional aesthetics and genres. But perhaps it is only the beginning of the end of the popular status of fine-art aspirations: just a Baudrillardian endgame for high art before it is absorbed and dissipated as a digital encryption, and the field is cleared for new players to emerge.

### **Aestheticization**

*The final goal of the avant-garde—the destruction of art as an institution and its introduction into daily life—couldn't be achieved. It became clear that the effects of art were in fact determined by its status as an institution and by the social framework in which it exists.... The intended proximity between art and life has been realized, but at the cost of a total aesthetization of daily life."*

—Isabelle Graw, "Interview with Peter Burger,"  
*Flash Art* 144 (Jan/Feb 1989).

The problem of access to the technology of production is soon replaced by the problem of access to a language. Never before have the means of production become so ahistorical, so dislocated from the framework of cultural praxis. For the amateur, the "low-end" user, the situation has always been to walk a tightrope of class identity between the introversion of the personal and the irrelevance of the concerns of high culture and "artiness." But there are certain forces that are now eager to develop new languages for electronic media and to define a practice that will fit comfortably into the aims and objectives of the mainstream art world.

Although "the arts" are commonly characterized as a socially monopolized activity—usually confined to the middle-class intelligentsia—through arts education and the exposure it intermittently receives through the media it can still function as a cultural standard of excellence. Despite the social program of the modern avant-garde to destabilize perception and cultural codes, art is still a strong normalizing force, defining what is aesthetically in good taste, what is creative, what is most worthy of serious attention. This ability to valorize what might originally be quite unencumbered by intellectual baggage has the effect of elevating non-art or the mundane into the respectable, but always in terms of values that are specific to certain classes and interests (recall the elevation of graffiti art during the eighties). Art is not democratic; it is individualistic. It does not provide a space for the social articulation of desires, but provides a platform for the subjectification of the experience of selected individual artists. Attempts to challenge the privileged mode of address afforded to the artists by participatory, collaborative, or retrograde approaches and yet retain a position on the moral high ground of contemporary art perspectives are faced with impossible contradictions.

By the mid-eighties we could see a resurgence of interest in electronic media of all kinds by artists, curators, and funding bodies. Once technological culture had become unavoidable through its prevalence in popular forms like videographics, computer games, and music, it was as though the time had come for digital media to now be saved from its vulgar origins and a process of aesthetic upliftment to begin. What better people were there to show off the enlightened things you could do with a computer than artists themselves? By the beginning of the nineties there were numerous calls for artists to become more and more involved in new media, computer technology, and electronic imaging, to use their "unique powers of creativity and imagination" to show what computers could do when put to "nondestructive ends." As one writer put it, "It is as if somehow (by sheer weight of numbers?) artists are able to rescue [technology] from bad uses."<sup>7</sup>

"Computer art," "electronic media," and "interactivity" have become the art-world clichés of the decade, an identification with innovation and progress that is part of the ritualized radicalism of mandarin taste. Promoted by the emergence of regular shows and competitions during the mid-eighties and appearing as an outgrowth of older festivals for experimental film, video, and music, shows of

interactive installations and screenings of electronic imagery are now de rigeur for the arts venue of the nineties. The "art and technology" show has resurfaced as an exhibition genre in its own right, with the occasional proviso that the work take a "critical" stand towards machinery and rationality. Curators and organizers scramble about desperately for any examples of computer animation, interactive multimedia, and global networking that they can massage into their selection criteria. Computer animation is now being produced at a manic pace—partly because it is now a component in one form or another of so many different kinds of activity. But curators find that many artists are only able to produce a minute or two of computer animation on their home computers, and often not to sufficiently accomplished standards. To ensure that their screening programs are long enough, curators must approach educational institutions, research centers, and commercial production houses to find enough pieces with that elusive level of razzle-dazzle that will satisfy their audiences' expectations.

The democratization of art was proposed as one of the goals of technological and computer art by commentators like Jasia Reichardt since the 1960s.<sup>8</sup> The intention was for those outside of the artistic community to plug in their computers, learn a programming language, and start producing mathematical art. The cerebral skills of logic were considered to be more within the abilities of an average person than the manual dexterity necessary for fine craftsmanship. Though it is questionable whether mental skills are more universal than manual ones, computer programming at least had the social advantages of avoiding the contentious medium of canvas and paint, with their long association with the elitism of art colleges and academies. In many ways this goal of widespread computer literacy has been achieved, not through cultural movements but through the aggressive marketing of commercial computer vendors seeking to expand their consumer base. As far as programming as a democratic form is concerned, by the 1990s the result is the opposite of what was hoped for. Now that graphical interfaces have become the normal means of using the computer, programming is no longer a necessary discipline to engage with. In the effort to differentiate a specific computer arts practice from other formations, a fine arts emphasis is now placed on art "which could only have been produced by the computer."<sup>9</sup> In effect this means work not produced using interactive packages but using specially written software—the implication being that now only serious artists learn to program.

This has been the direction taken by the annual Prix Ars Electronica competition, associated with the Ars Electronica festival held in Austria every year. In 1992 it deliberately set out to restrict prizewinners to those working in computer-specific artistic genres (effectively defining computer art as algorithmic art), with the result that nearly all that year's prizewinners were people who wrote their own soft-ware. A peculiar result of this policy was that most winners were from computer science and engineering backgrounds, since they were the main group possessing the right technical abilities. As Peter Wiebel states in the catalog "[W]e are dealing with scientific artists (or artistic scientists) who develop those custom programs necessary for the creation of their images."<sup>10</sup> The likely prospect is that future "computer artists" will exclude not only those from marginal social groups, but also most artists as well. The irony, however, is that the group benefiting most from this kind of definition will still be from outside the art-world establishment, namely, the scientific community.

Many "computer art" events have developed out of non-art organizations such as academic conferences and commercially sponsored trade shows. The friction this caused in the early days with the established art-world means that this is still a highly contentious area. Computer art shows tend to swing between actively courting art critics and curators with invitations to take part in seminars and committees, and developing their own alternative festival circuit with its own "stars," publications, and ideological gurus. At first, those active in academic and commercially based art shows would bemoan the fact that the work of their colleagues was ignored by the mainstream art world.<sup>11</sup> Their neglect was frequently rationalized by arguments that the immaterial nature of digital media meant there were no unique art objects that commercial galleries could exploit, quite ignoring the fact that most public and noncommercial galleries had exhibited conceptual art, photography, and installations for years. More recently the public interest in high-tech media and the shortage of electronic art work has resulted in curators being more tolerant of including this more academic kind of work in their programs. Also, the attraction of artists to institutions boasting state-of-the-art equipment has meant more of a dispersal of talents and resources between these two "cultures."

The technological art form that has come closest to carving itself a space of sorts in the established art world is that of the "video art" and electronic media groups, who managed to come to terms with their

derogatory associations with television and military technology and set up their own festival circuits and support organizations at the end of the 1970s. The video art world has since then negotiated an uneasy marriage with the TV industry to the extent that broadcasters have become an indispensable sponsor of cultural institutions, a situation made more imperative by changing political tastes in state funding. It is this collection of cultural organizations and its links to distributors, galleries, critics, and curators that often seems to be caught between opposing the encroaching computer technology with its artistically naive pretensions and "politically incorrect" associations with state power and the military-industrial complex, and wanting to embrace a new field of activity that may bring an increased public interest in the arts and the promise of new forms of corporate and institutional sponsorship. More recently events have brought these two factions closer together as their power bases have felt the need to expand and break their isolation. The computer industry has the financing to support the conferences and exhibitions that it has built up, and arts organizations have the infrastructure and political connections to extend the range of these activities into the cultural sphere.

Scientists and members of the media industry are now frequently invited to art conferences and seminars to lend an aura of scientific legitimacy to the discussion. The academic institutions that fuel research in the computer industry provide a source of information and background for the writers and critics who feel acutely embarrassed by their ignorance of technological media and whose art-theoretical tools have not progressed since they read Virilio's *War and Cinema*. Panel sessions at arts seminars typically display an extraordinary degree of theoretical cross-referencing, mixing of terms, and plain word juggling. An "art and technology" conference will frequently veer wildly between discussions of interactivity, "virtual reality," computer animation, and surveillance systems, each criticism being haphazardly reapplied to each new phenomenon in turn. Spurred on by a continual barrage of eloquent descriptions of new technological innovations, current theories become unable to keep up the pace and often collapse into attempts to redefine the basic terms of debate: What is Art? What is Technology? The sight of our leading cultural commentators making hopelessly inaccurate or overgeneralized statements about digital media causes a feeling of bewildered inadequacy in the audience. Scientific "experts" invited to provide objective accounts of information technology look on, seemingly at a loss to understand why a simple thing like

making pictures with a computer should be causing so much concern for the arty types.

The range and diversity of digital media, graphics software, and electronic effects continue to grow unabated. Computer systems and packages are superseded by enhanced and expanded versions at a rate that defies the user to keep up. It is a struggle to absorb the special abilities and applications as technology lurches inexorably onwards, a struggle matched only by the efforts of writers and critics to elucidate their cultural and aesthetic implications and possibilities. Every attempt to clarify and categorize one of these manifestations is soon made obsolete by its next incarnation. The efforts of critics to determine the poetics and grammar of the new aesthetic are relentlessly overtaken and rendered trivial or hopelessly shortsighted by another barrage of inventions and products. Computers consume theory. For every "theory of the new media," supporting examples can be found, and contradicting ones. The pure symbolism that underlies the functioning of the computer frees it from the physical constraints and structural properties that anchor thought to fact and ground theory. This unbounded formalism ruptures and fragments theoretical work until it becomes a game of rhetorical space invaders. Discourse becomes introverted, contingent, without currency.

But it is this relentless tide of innovation that technological commerce demands that can provide the space to resist the reactionary ideologies of aestheticization and keep the channels of cultural access from clogging. Technological art-forms become a way to continually defer the recuperative powers of cultural hegemony, a way to keep it off balance by always taking on a new guise, ready to introduce some new sector of the non-art community onto the scene. From this vantage point we take the opportunity to work in a new space between the gregarious snobbism of state-sponsored arts and the tasteful foyer-art of corporate monoculture. The development of electronic media as new means of expression is therefore not only an aesthetic challenge but takes on a social and political dimension outside the usual parameters.

## **iF**

The year 1991 saw the release of *Mental*, "Britain's first computer-generated comic."<sup>12</sup> It emerged as the third issue of *iF Comix*, an independent title started a few years ago by Graham Harwood. The previous issues had contained a similar polemical thrust, with post-

situationist references, plagiarized imagery, and varying degrees of digital post-processing. Most noticeable about this issue, however, is its distinctive "look." Every graphic appears to be cut out of sheets of anodized steel, with hard and crisp tones. The graphics are simplified in some places but greatly detailed in others, and frequently broken up by sharp horizontal bands. The metallic appearance is not like the usual look of pristine computer-generated geometries; it is more as though the drawings have been etched or burnt into steel plates, leaving tarnishes and rivulets of molten metal.

These effects are achieved by image-processing software that Harwood has developed himself, which is applied to the images once they have been scanned into his computer. Nearly all the art-work is culled from nonoriginal sources, ranging from s.f. comics to the *I Spy Handy Craft Book*. The scanned pictures are processed into a single style—sharp and glistening, but also gritty and even dirty looking. "It's about the Gulf War and technology and the metallic look suited that," Harwood explains. "Also, cyberpunk never really had an aesthetic of its own, and I wanted to produce a style for it that fit the present. I wanted it to look like the images were pressed out of steel, stark and hard." Included in the comic is an A2 poster and a 45 rpm record, composed by sampling and collaging sounds and dialogue from war films, s.f. films, and CNN news broadcasts—"but it's still danceable," says Graham. The text tells the story of a working-class fighter pilot in a Gulf War type scenario, but the script is mainly pieced together from documents and leaflets like Marks and Spencer sales promotions, British Petroleum handouts, and more news broadcasts.

Harwood is normally described under the rubric of "cultural activist" and the strong anti-art component of his work has normally revolved around opposition to art-centered notions of genius, originality, and authenticity. An important strategy in this counterculture ethic is to use means of production that are outside high-art practice, especially if such means are familiar to the non-art community. Strongly emphasized is the anti-aesthetic way of working—the ad hoc improvised style that rejects the finely tuned skills of the artisan based on the artisan's submission to a socially constructed system of training and apprenticeship. The use of photocopiers has been particularly highly regarded as a nontraditional medium, lending itself well to the recycling of mass cultural debris into rambling collages commonly found in counterculture publications.



Fig. 4.1. Digital image from cover of iF Comix, "Mental" by Graham Harwood (London: Working Press, 1991). Reproduced with permission.

This rejection of artistic professionalism was an attitude well known to Harwood himself before his exposure to digital imaging methods. Originally attracted to computer graphics as a tool to speed up the process of cutting, pasting and manipulating imagery, Harwood found the quality of work that the computer could effortlessly synthesize suggested a new approach. The collaging techniques now available were of a photographic finish and veracity that far surpassed the confrontational power of what was possible before. Somehow the technical superiority of the production methods available and the seamless recombinations of imagery forced the viewer to take the result more seriously. The finely crafted montages looked almost as though a virus had invaded official mass culture and turned it into a pathological beast, turning around and snapping unpredictably at its keeper. Though sacrificing the counterculture aesthetic of old, electronic media and its subdisciplines like desktop publishing do provide access to some of the means of mass production and a way to colonize the mainstream aesthetic that allows its users to "speak in the voice of the dominant culture." Such techniques point towards a possibility for marginalized groups to have their position taken seriously by *any other class*, not just as an art curiosity, but as an active cultural agent.

For most cultural activists working on the political margins of art, magazines and pamphlets have been an important channel of expression and opposition. Now the comic book form is proving itself a particularly flexible way for independent producers to make them-selves seen and heard. Since the mid-1980s, commercial comics have made important steps in leaving their "kids-only" reputation behind and finding new "serious" readerships. With these new extended markets and the graphic possibilities of combining image and text, comics offer a form of media able to operate as an individual means of "artlike" expression, but also able to take advantage of its function as a reproduced commercial commodity. Comics like iF sell in comic shops and bookshops as well as art gallery shops.

Graham had previous project work censored and confiscated from public art galleries, and independently produced comics provide him with unparalleled freedom. The same commercial pressures that compel art curators to compromise prove unexpectedly liberating in the commercial media sector, whose only requirement is to sell. "I can do whatever I like in comics," says Graham. "It's an escape from art to a wider audience and I'm independent of publishers and distributors." (Some years ago Graham helped set up

the Working Press to support publications dealing with working class culture.) "You know I see art as a class practice in the U.K., but comics work in a wider cultural context." Graham bases his production around an IBM PC running PageMaker and some image-processing software that he learnt to write while in a part-time course at London Guildhall University. "It's all done on cheap and accessible technology. The PC costs about 1700 pounds, and it costs me about 2500 pounds to print 1500 copies of the comic."

A lot of Graham's source imagery originates from the comic strips of his youth—the Eagle comics, *Voyage to the Bottom of the Sea*, *Dr. Who*. It's partly an attempt to reclaim my boyhood culture. The aim is to re-work my culture anew, for myself and for others." He goes on to explain, "[A]fter the loss of Marxism, there's no alternative to capitalism. People say 'but now there's only capitalism, capitalism has won.' So there's no resistance to the dominant culture."

The battle for visibility in mass culture, for submerged forms to develop and reassert themselves, is an area in which new opportunities are emerging. The old forms of working-class culture and other local narratives will not survive unchanged, but new avenues into cultural production, many coming from non-art directions like new technologies or practices like scratch and plagiarism, can bypass the more class-conscious side of the necessary cultural and intellectual baggage. The challenge for these new "cultural workers" now is not just to throw up new aesthetics and reappropriate cultural forms, but to evolve genres that are neither art-based nor propagandist, but relevant, accessible though polemical, and even entertaining.

We can see, then, how the themes of mobility, democratization and aestheticization can come together. The role of computer programming and mathematical design in such areas as image processing brings new resources of knowledge to disciplines previously distanced from them. Combinations of text and graphics merge into a product that takes advantage of commercial channels to operate on more than one level. Democratization appears in the guise of extensions to popular culture and the encroaching into mainstream production values by independents. And aestheticization, instead of enforcing structures of dominance, develops distinctive new styles to reinvigorate a marginalized culture.

Unfortunately there is only room here to describe one example of a future for electronic media practice. Another study could talk about computer networking as an alternative method of distribution, and one not far away from being able to access and play back digital video

and animation as well as text and graphics. Still another could extend the independent comic book scenario into moving image culture and the growth of independent electronic cinema. Or the potential for electronic games as fiction and play to combine through interactivity to suggest a new narrative structure. Although past advancements in technological media like radio and TV proved easily centralized and were absorbed into prevailing power structures, it must be stressed that the pace of technological innovation is now so accelerated and diverse that contradictions in its functioning and unpredictability in its control are almost inevitable and ready to be exploited.

Technology acts as a cultural compressor, squeezing practices and languages down onto a single sheet of features and pathways. Media has leveled down our experience to be inscribed into a cartography of forms. Hierarchies of access and discourse have been mapped out on a common terrain and forced to become paper thin. Technological pressure reduces artifacts and craftsmanship to information and digital processes—they are standardized as digital data and yet at the same time able to perform signifying functions and resist entrenchment. When the top and bottom of cultural stratifications are pressed into closer proximity, it is easier to overcome barriers between parts and for the potential for new cultural strategies to emerge. The impact of technology will not be to just provide economic access to the means of production, but also to restructure in new terms the practices and modes of expression that have confined any activity to a social class.

*In our college we run courses in computer graphics that typically attract students from a wide range of backgrounds—artistic and social. Every year we take students who have not been through the usual art-school system—perhaps from scientific or technical backgrounds, or perhaps people who are artistically self-taught or come from sectors of society where their position precludes any involvement with what they perceive as the cultural establishment.*

*One student I have been tutoring recently is of the latter type. He comes from one of the most deprived areas of northern England—he shows me photos of young kids playing in a muddy wasteland of broken timbers and sewer pipes against a backdrop of concrete tower blocks and washing lines. Working as an artist for some years now, though completely outside the art-world or design industry, he sells his work to local people where he lives. After building up his skills he was able to leave the town he was brought up in to take a job on the sup-*

port staff of a computer vendor and now finds the confidence to take a course in art and design.

He can only afford to put in the minimum number of hours on the course, but he works hard and uses his own computer at home. Recently he has been having difficulties on the course. He sometimes feels isolated from the rest of the class, unsure as to what direction his work should take, not knowing how to gain approval, unable to identify with the attitude of the typical art student. He hates the egotism of the world he finds himself in, can't understand its introspection, resents its hypocrisy, is alienated by its values—but with a little support from us he will see the course through.

## Notes

1. Constance Penley and Andrew Ross, eds., *Technoculture* (Minneapolis: University of Minnesota Press, 1991).
2. Richard Wright, "Computer Graphics as Allegorical Knowledge : Electronic Imagery in the Sciences," in *Siggraph '90 Art Show Catalogue: "Digital Image-Digital Cinema,"* (N. p.: Pergamon Press 1990).
3. H. O. Peitgen and P. H. Richter. *The Beauty of Fractals* (London: Springer, 1986).
4. Ibid.
5. Laura Trippi, *Strange Attractors: Signs of Chaos*. Exhibition catalog, New Museum of Contemporary Art, New York, September 1989.
6. Philip Hayward, "Beyond Reproduction," *Block 14* (Autumn 1988).
7. Andy Darley, "Big Screen, Little Screen. The Archaeology of Technology," in *Digital Dialogues*, special issue of *Ten8* 2, no. 2 (1991).
8. Jasia Reichardt, *Cybernetic Serendipity* (N. p.: Studio International, 1968).
9. Peter Weibel, "Jury Statement," in *Prix Ars Electronica* catalog, (Linz: Veritas Verlag, 1992).
10. Ibid.
11. Delle Maxwell, "The Emperor's New Art?" in Isaac Kerlow, ed., *Computers in Art and Design*, ACM Siggraph '91 Art Show Catalog (New York: ACM, 1991).
12. Graham Harwood, "Mental", *iF Com ix*, no. 3 (London: Working Press, 1991).