



- Three educators from different universities, the Illinois Institute of Technology, Chicago, Illinois, the University of Reading, Reading, England, and the Rochester Institute of Technology, Rochester, New York, discuss their experience with integrating computer graphics into their graphic design programs. The following "conversation" took place during a period of seven months. The discussion moves between practical and philosophical issues and between a specific graphic design education perspective and a more general design perspective.

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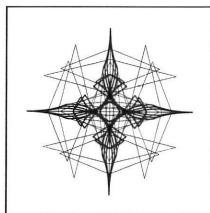
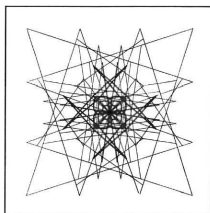
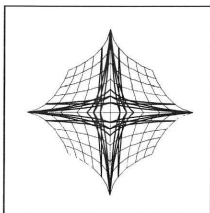
Sharon: First, let me introduce the three of you. **Charles Owen (Chuck)** represents the program at the **Institute of Design, Illinois Institute of Technology**, where computer graphics have been taught continuously since 1970. **Chuck** has written many computer graphic programs, some dating back to the mid '60s. **Roger Remington**, along with his colleagues **James Ver Hague** and **Robert Keough**, represents the program at the **Rochester Institute of Technology**. Their experience covers six years and includes the recent addition (1984) of a graduate **Computer Graphics Program**. **Michael Twyman** represents the program at the **University of Reading**, where theoretical involvement with computer graphics began around 1968 and "hands-on" experience became available in 1979.

What prompted your department to develop computer graphic capability?

Michael: The move towards computers was prompted by our seeing them as an inevitable partner in the business of graphic communication. But I'm not sure we thought the thing through very carefully in the late sixties and early seventies.

Chuck: For us, the move to computer graphics was a natural move to include graphic capability with the other computer techniques that were under development in the school. Computer graphics have always been considered as a means to an end—a better way in many cases to present or explain a result.

Roger: Personal and professional interest by key faculty together with support by administration stimulated our development of computer graphics. The Graduate Computer Graphics Program has met with a high degree of interest and was immediately at capacity enrollment.



An image in a grid is used to generate unpredictably new forms. **Illinois Institute of Technology:** Charles Owen, Deform program.

What were the basic problems in determining a strategy for developing computer graphic capability within your school?

Roger: It was not so much a problem of strategy as it was a matter of obtaining hardware—even dealing with the diversity of hardware available. We did need to develop a more homogeneous conceptual attitude. Some of the basic problems were no resources and limited local and national faculty. The strategies included developing faculty, space, administrative support, hardware/software, and curriculum. The facilitation of two major national conferences on computer graphics at RIT enhanced our development.

Michael: Lack of funds and our own ignorance of the field, in that order, were basic problems for us.

Chuck: I can't say that there have been any problems, primarily because we didn't sit down with the intent of introducing computer graphics broadly and all at once. The capability came naturally with faculty members that wanted to work with computers and the good fortune that computing power was made available campuswide in a very open way. What difficulties we had obtaining computer graphic capability came at a time when plotters were the only real option. We overcame that problem by treating it as a campuswide need.

Access to computing tools is a necessity. Your departments were selected to participate in this issue because you have succeeded in getting computers in the design department. While I don't want to dwell on equipment, securing good, often expensive computers is not easy. What has been your experience in getting hardware and software donations? How do you get your leads? Are there no strings attached?

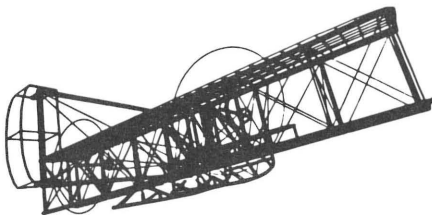
Chuck: We have had approximately one million dollars in equipment and financial grants. Each company is different in its approach to donations. Small companies have more difficulties than large ones, particularly when their product is an expensive one, but some large companies have such complex policies that they are as difficult to deal with as the small ones. In general, all companies want to know that their donations are going to be used effectively; and most want some tangible return for their largesse (Hewlett-Packard and IBM are notable exceptions here).

We had to create the justification for a company to become involved with us, either because our record of achievement was worthy of a philanthropic donation or an association would simply be good business. This meant that we had to be doing things that a company was interested in. This covered a wide range of possibilities. On the basis of fifteen years of work in the field, we put out our first proposal in 1980 to Hewlett-Packard. In the proposal we explained that we felt that

the work we were doing had a wide range of application in disciplines employed by HP, well beyond the product and visual communication fields we cover with degree programs. We also showed a number of benefits we felt they would enjoy from an association with us. After a year of presentations and discussions, we received our first major grant from HP, which inaugurated the Design Processes Laboratory. Donations from Digital Equipment Corporation and Amdek Corporation quickly followed. Contributions in both equipment and cash have continued annually since 1981.

What we do with companies varies widely. We are generally not anxious to do contract research work because we don't want to dilute the efforts of ongoing projects, and we feel that the areas we are presently working in are of real value to these companies. We have developed ways of working, however, that are of mutual advantage to us and to those companies that wish to be closely involved in our research. As a result of this, we are now developing a contractual arrangement for an "Industry Affiliates Group" to support and benefit from research in our laboratory. First members joined in 1985.

Two aircraft "demonstration" models. **IIT:** Gossamer Condor, Paul Lionikis; Wright Brothers' Flyer, Kuohsiang Chen.



Michael: There isn't the tradition in the UK that there is in America for computer companies to make donations. Despite numerous overtures over a long period we have been singularly unsuccessful in attracting gifts of equipment.

Roger: You must define what you want to do. Our Genigraphics contact was made slowly through a series of meetings—building an understanding, rapport, and credibility between faculty and the contacts. The Artronics conference held at RIT proved to be a good place to find more connections and leads. Computer companies (Apple, for example) make large donations to educational institutions, but it is important to have special strategies in the approach to these organizations.

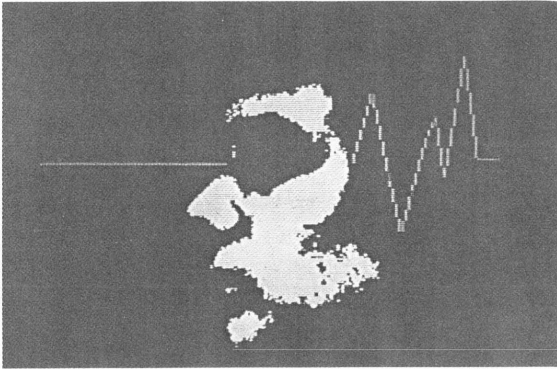


Image scanning, 2D drawing, and other computer graphic manipulations.
Rochester Institute of Technology: Robert Keough, instructor.

Based on your experience, what are the essential elements to consider prior to acquiring hardware?

Michael: What we want to use it for. In an educational context I would say the following: capability, user friendliness, compatibility with other systems in the institution, and quality of graphic image.

Roger: Software is more crucial than hardware. First, consider your objectives in using computer graphics; what do you want to do, then identify the software and find the equipment with which it is compatible.

I/O ERROR

I/O Error, a logotype created for a computer graphics publication at RIT, was created totally on-line. **RIT:** Craig Malmrose, MFA candidate.

I/O ERROR

I/O ERROR

I/O ERROR

I/O ERROR

I/O ERROR

I/O ERROR

Chuck: Maintenance should be included in the fundin established to buy a system; a maintenance contract with the supplier or manufacturer is just about a necessity. Another problem is who is going to take care of the equipment, develop new uses, and teach students the nuances of use. Too often this is the faculty—perhaps a serious mistake. Faculty should have overall charge, but staff should be hired to operate, supervise and provide day-to-day help for students. Staff support frees the faculty from myriad annoyances that detract from true faculty responsibilities. It also prevents territorial restrictions that can develop, whether intentional or not. Security may be a problem, depending on the school—especially now that so much power can be put in a small box. I remember visiting a campus in the 1970s when the design department’s computer had been stolen just before I arrived (it was returned when the students who had taken it couldn’t program it well enough to use it!). Expectations can be high, so preparation should be done to make sure there is something that can be done with the computer/s when they arrive. Some software is available, but so much of it is either trivial or awkward for design use that a real effort may be necessary to find startup programs. Writing your own is a good answer, but I’ll come back to that later.

Michael: We cannot afford to pay maintenance contracts even on the equipment we have at present. If we entered into contracts there would be nothing left for anything else. The more general point about care of equipment is certainly worth emphasizing. We try to “make do and mend” with the help of our Computer Science Department and Computer Centre.

Security is also a problem, but only in relation to breaking and entering. We aim to create an environment in our Department that rests on trust and responsibility. I hope this will always be so!

I/O ERROR

I/O ERROR

I/O ERROR

What materials, people, and conceptual understanding are important to getting started in computer graphics?

Chuck: Let me be more specific about maintenance and address the security problem too. For our costly equipment, we have maintenance contracts which tend to run 5 to 10 percent of the purchase price, so we do not have contracts on everything. In some cases, where we have multiples of equipment (low-cost items), we either fix it ourselves or cannibalize parts. Our laboratory manager is extremely good at troubleshooting and repairing equipment, fortunately!

Security has not been a problem. We have most of our equipment in rooms that have to be entered from other rooms—so there is no easy “grab and run” path. We treat the laboratory as a resource for the school and work hard to provide as much access as possible; there are students around most of the time. In three years of operation, we have had only one case of damaged equipment, and that was accidental. One theft of a modem turned out to be a “loan” when we passed the word among the students that it should be returned.

Michael: Any start in computer graphics is best made in relation to some real communication problem. Some things about design—and some of the most important—can only be learned by designing. I would therefore try to create a situation in which the role of the designer in relation to computer communication is brought out in some way. I get rather tired of the use of computer graphics as a plaything.

banana

arab nab

hannah

An original typeface, designed and digitized using a type drawing system developed by Richard Southall. **University of Reading:** Jonathan Coleclough, student.

Roger: Take a practical approach: first develop formal visual design skills, then develop an open, receptive attitude toward computer processes and equipment, and then, as technology gets more sophisticated, develop more emphasis on basics.

Chuck: The key is people. With good people, all is possible. First you need a designer who knows computing and can write application programs. He will get something going, even if it means using the general university system and other laboratories. Eventually, he will find the means to get the right equipment and software (if he doesn't write it himself).

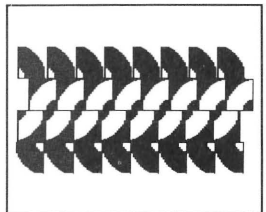
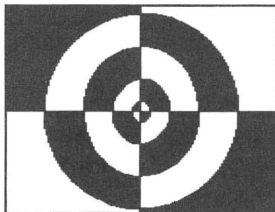
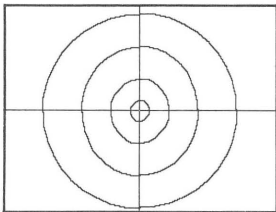
A system can start small with a microcomputer and a plotter for output. Students can learn to program in the general university classes. If no equipment is available for the department, the general university system usually will have some form of graphic output.

Programs are hard to find as yet, but drafting is a possibility and paint programs abound. A major difficulty may be the shallowness of some of the software (paint programs do get old after a while). This is where a good faculty member and some persevering students may be able to contribute by gradually building up some software to do the things of greater specialized interest.

In general terms, what impact has the computer had on your department?

Roger: The new technology has generated a high degree of student interest from freshmen to graduate majors. Computer activity is expanding within the college to include the foundation program. The Graphic Design curriculum has a mainstreamed computer graphics emphasis from sophomore through senior years. Typography is a major focus in the middle years with seniors having greater access to the equipment and flexibility in its application.

Our objectives are threefold: to integrate materials taught on different levels, to use the tool both as a

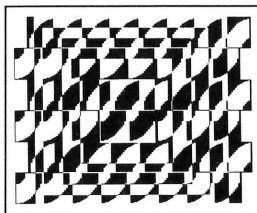
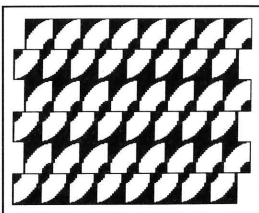


complement to traditional skills and for its unique capability, and to be responsive to changing needs in the field.

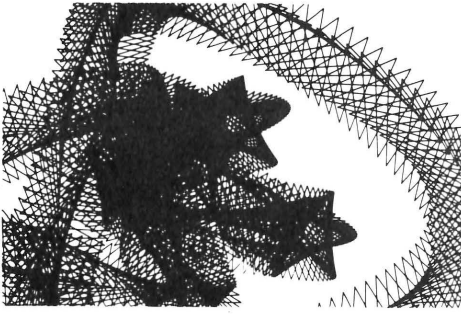
Michael: Over the last few years the impact has been considerable. It can be calculated not so much in terms of what equipment we have acquired and what we have actually done, as in terms of forcing us to rethink our position on a number of issues. In particular, it has sharpened our commitment to study graphic language across technological boundaries and reinforced our belief in the importance of the intellectual and managerial aspects of design. In practical terms the impact has led to all students being given hands-on experience of terminals and the design of information on them the first year of their undergraduate course.

Our major educational objective is to develop logical methods of working. There is also the more general issue of demystifying computers....In terms of vocational objectives it is clear that all those intending to involve themselves with typography must have an understanding of computers as they relate to text-handling systems.

Chuck: Because we began 20 years ago, the impact in development has been subtle. In the beginning there was general resistance among students to using computers—we had to require courses or really sell them to recruit students. Over the years there has been a gradual increase in the use of computing in courses. The university began requiring all students to take a programming course in the early 1970s, and slowly but surely we have added computing capability in a number of courses. Undergraduates now may take nearly a dozen design courses that in some way use computers, all the way from canned processes to program writing and actually building microcomputers for design applications. In essence, it has been an evolution rather than a revolution.



Software package with an "electric" cut and paste operation creates repeat pattern from original design. **RIT:** Norm Williams, instructor (Freshman).



A program for studying forms of motion created in two dimensions. IIT: Cross, Charles Owen; Star, Marshall Chanzit.

How can designers adapt or prepare themselves for the new design environment?

Roger: Professionals need to look to new opportunities for continuing education. We need to spend more time on conceptual skills, and idea generation. There needs to be an attitude of openness and acceptance; without this it is hard to receive the benefits of new learning and growth. These benefits—cost saving, doing a job better, and better communication—are elements for which a good design firm looks.

Chuck: How a designer prepares himself depends on his age. Students coming through the high schools today are learning to program computers. For them, the issue is what next now that they know how to program and use a computer. For designers who left school before the computers arrived, there are more barriers to remove. I think that the “fear of computers” is not as great a bugaboo as we have been led to believe, but there is the problem of learning to use equipment that younger people with less seniority already know how to use. For senior designers, the problem is similar to that of managers generally—being a neophyte in public is difficult. A good solution is getting a personal computer and using it at home to come to grips with the major ideas; the cost is justifiable for the increase in word processing productivity alone.

Fortunately, the software available for designers is still not significant, so anyone choosing to learn about computing today is not far behind. On the other hand, the lack of software is in part the result of the failure of the design community to become involved in producing its own. There is a great need for designers who are expert programmers and able to think about these problems of design in ways that can be translated to software. Preparation of this kind has the potential for real financial reward in the next decade.

When will there be a sufficient library of graphics software for the designer to use the computer fluently? Have you any ideas for making graphics software more readily available now?

Michael: This is a crucial issue and it is why I believe the sort of people we take in our course (typography students) should be taught programming. Clearly it will be years before the software on the market caters for all the needs of the community. Market forces will lead to the satisfaction of the most widespread needs, and government might satisfy some others, but traditionally—and I don't see this changing—graphic communication has been concerned with countless minority needs. It seems to me that many of these will only be satisfactorily sorted out if dedicated designers take the trouble to write software or modify existing software to meet their standards. The alternative would be for some charitable institution to put up the money for such work to be done under the direction of the designer. The sorts of things I have in mind relate to niceties of spatial distribution. It has been hard enough to secure them in traditional printing/publishing; I can't see them being considered in minority areas of the new technology unless some designers become directly involved with software development.

Roger: We are optimistic and 1990 sounds good to us. There are already collectives. We need to interact with existing software and re-market their products. Economically speaking, widespread use would cause prices to decline. Right now everyone would like a Sci-Tex at the cost of a MacIntosh.

Chuck: Exactly! If you have the money, there are some fine systems available today. For the graphic designer, the Sci-Tex system will do most of the things done in composition and production, allowing an operator working at a terminal to combine photographic images with type and images created manually and scanned in or painted in directly. Graphic arts procedures are incorporated in the system and the output is plates ready for printing. Other systems for CAD are equally good for product designers, engineers, and architects. The problem is cost. Hardware to do high-quality color work is still expensive, and sophisticated software is also prohibitively costly at this time. The good news is that capability is going up while costs are coming down. For the first time, hardware/software packages within reach of the small office were offered in the

summer of 1983. These packages offered color graphics in the medium resolution range with plotter output and software to do two-dimensional drafting for ten to fifteen thousand dollars. Paint programs are also available at low cost. Programs specifically written for graphic and product designers still do not exist—or are well hidden (we have a few for sale that we don't advertise, for example). Part of the reason for this is that there is no perceived market yet.

Software companies have not seen a design market because it hasn't existed. Few designers have experience with computers; many still do not trust computers; and, except in larger corporations, few have had the money to spend for a system that might be able to help significantly. Given the opportunity to choose a potential market, the software companies have chosen to develop graphic programs for applications in areas where their efforts would be rewarded economically. What we can probably expect to see, since our applications require their own special development, is the same kind of evolution that took place in the special areas of science and engineering; important steps will be taken first by designers programming (or specifying programs) on their own. The software industry will expand on these when they see the market interest.

A potential supply for programs exists in the universities as researchers develop new software. Two graphic programs were extended to commercial use at our school last summer, and a third is nearing completion. These are specialized to the creation of certain classes of images—something that designers can do better for themselves than others can.

As we discuss software, we bump head-on into the question of whether graphic designers should learn to program. What do you think?

Roger: It is beneficial but not necessary. It is essential if you wish to develop your own software. It assists in logical thinking and makes a more capable designer.

Michael: There is some mild difference of opinion on our staff. My response relates specifically to our students, who are supposed to have a strength in typography. I would not argue the point in relation to all graphic designers. But I do believe all our students should have some instruction in programming for the following reasons:

1. Some involvement with programming leads to better understanding of what computers are about.

2. Programming provides a good training in clear thinking and therefore has some general educational benefits.

3. There is a need for typographers who can write software.

However, I don't believe all our students will become skilled programmers. There should be sufficient instruction in the field for objectives 1 and 2 to be achieved. Some students will wish to go further than others and the hope is that they will satisfy objective 3.

Chuck: This is relevant only to the generations over 20 years of age (or, to be more conservative, those over 14). High schools are teaching programming and many colleges and universities are (as we are) requiring all students to learn to program. For those who never learned, the question has to do with how much they wish to be involved. You don't have to know how to program to use graphic programs, and software will continue to improve to make it easier for the novice to be rapidly productive.

Michael: Your comments might be true in relation to America, but they do not apply equally to the UK. We do not find many students entering our course with programming skills.

Chuck: It is true that all cannot become highly skilled; however, it is very important that some designers become expert programmers to become involved in design applications research and the creation of design software. Finally, since it's fun and creative people do the most creative programs, why not?

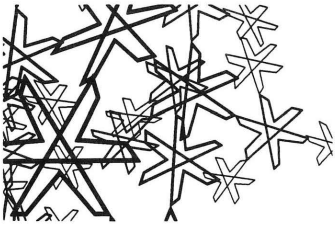


Fig. A

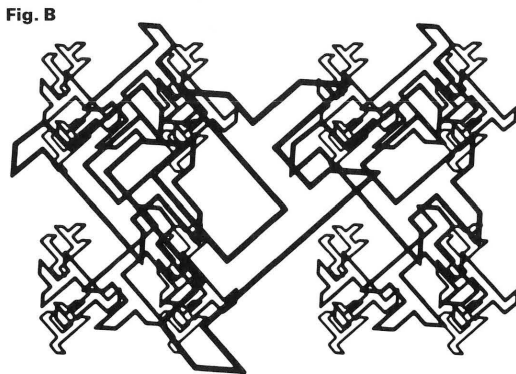
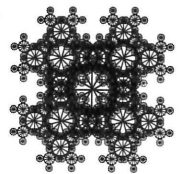


Fig. B

Fig. C



Complex forms developed by "growing" images with seed forms and rules for reproduction (Growth).

IT: Fig. A, Alonso Miranda; Fig. B, Constance White; Fig. C, Christopher Nemeth.

Let's take a closer look at some of the philosophical issues surrounding design education and the computer. For example, what do you think is legitimate use of the current technology?

Chuck: I would like to say all things are legitimate, but that would have to presume high quality hardware and software. Most schools do not have enough good equipment to justify a great amount of time with computer graphics. To the extent that students learn about computing and have some appreciation of computer graphic possibilities, low-quality systems are appropriately used. If an inordinate amount of time is spent with equipment of this kind, however, something else in the curriculum must be sacrificed—unwisely. If the equipment is good, then more time can be used well because issues of sensitivity can be brought in that will not have to be taught in other courses. Legitimacy, in other words, is not so much an issue of content as it is an issue of quality.

Michael: There is a lot of sense in that. It worries me that our students will be exposed to such "low-level" devices (for a few years at the very least) and so run the risk of becoming immune to their visual infelicities (in particular, their crude letterforms and letterspacing). It is all a matter of amount of exposure and counterbalances. We introduce students to computers as design tools and communication devices; but at much the same time we involve them in setting type by hand and looking at examples of fine printing and inscriptional lettering, to introduce them to images of visual quality. At a later stage, as output devices improve, this dual approach may not be so necessary.

Below: An example of inscriptional lettering (from a 19th century French manuscript) is contrasted with Neuland, a typeface designed by Rudolf Koch and digitized using a type drawing system developed by Richard Southall. **Reading:** Marcus Cole, student.

Right: Nine modes in which an artificial intelligence program under development (Walter) will be able to help the designer. **IIT:** Charles Owen.

INSCRIPTIONS ANTIQUES

NEULLAND

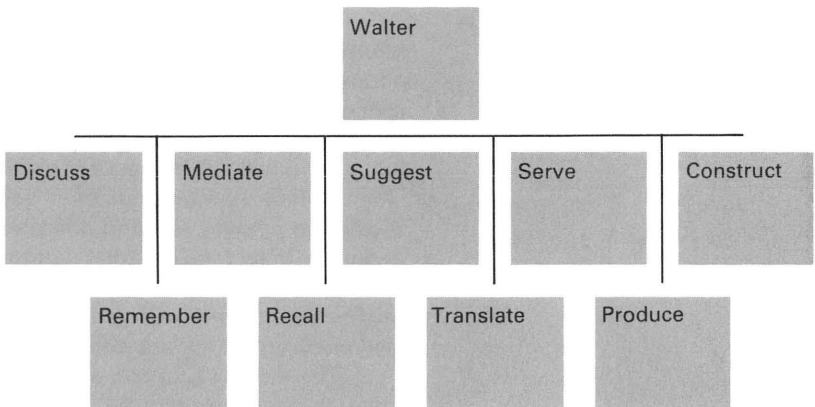
We can push this idea a bit further. When is it not appropriate to use the computer?

Roger: The usual design criteria of time/cost effectiveness and capability to communicate what you need to say visually apply; it can be evaluated like any other tool. It is not appropriate when it cannot solve a particular design problem.

Chuck: It is probably not appropriate to use the computer extensively in foundation training. There are some very good uses at this level, but it may be unwise to eliminate too much of the hands-on media and material experiences. Otherwise, it is not appropriate when there are better ways to do things or it is too hard to use the computer. These are not permanent conditions, and it is part of our responsibility to remove them by improving computer-supported processes and inventing new ones.

Faculty and student research (at the thesis level) are our primary means for exploring new computer uses. Most Masters level theses are involved in this effort, and our "Walter" project provides a means for structuring the relationships among them.

"Walter" is a major faculty research project. It involves the design of an artificial-intelligence based system to act as a research and production assistant for the designer. The system will discuss problems, suggest and provide design tools, remember and recall information, mediate conversations with other designers over computer conferencing link-ups, translate data from one form to another, help the designer to build new computer tools and aid in the visualization of concepts.



What specific design skills does the computer sharpen?

Roger: It tends to sharpen all skills, especially the ability to examine a visual problem more rigorously because of its time-saving drafting aspects.

Michael: I suppose it might sharpen the analytical skills of the designer, but it may also lead to a neglect of the human relationship aspect of designing. I start from the premise that design has to do with human needs. Effective design usually involves a lot of interaction with people as part of what has aptly been called the "twig gathering" stage of the exercise. This is a prerequisite for entering the analytical and synthetic stages of design. Design also involves getting feedback from people at various stages. My fear is that these essential stages in designing, both of which involve people, might be undermined by a kind of "electronic umbilical cord." There is no reason why this fear has to become a reality, but in my view it will do so unless we recognize a potential problem and do something about it in terms of defining these human stages in designing.

Chuck: Assuming the full range of computer use, programming as well as use of programs, the use of computers seems to sharpen design skills related to analysis. In the area of sensitivity, I don't have enough evidence to make any real judgment. One hypothesis might be that because the computer permits the fast generation of alternatives, sensitivity would increase through continual exercise of judgment. There is the counter hypothesis, however, that sensitivity decreases with distance from the end media.

In what ways does the design process change because of the new technology?

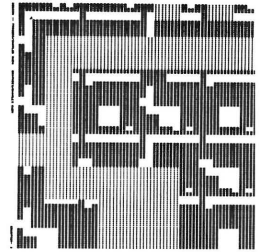
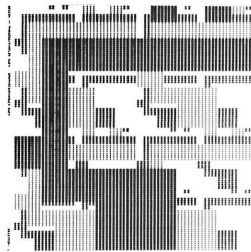
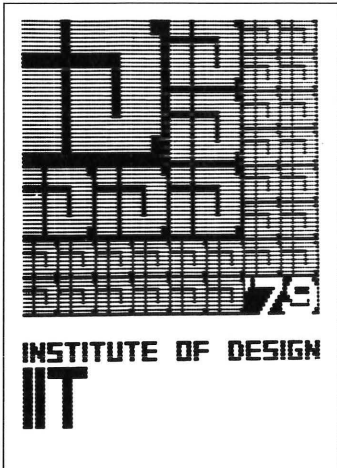
Michael: This is the fundamental question for the educationist. Clearly the basic issues and some of the procedures stay the same. The problems are not going to change simply because we have computing facilities; there will still be users of different kinds to consider, different circumstances of use, different communication objectives, and different constraints of cost and time. In fact the greatest danger might well be that we begin to lose sight of what designing is about simply because these exciting new tools have come along. We must remember that they are only tools.

There are, of course, areas where computing is going to affect procedures. The most significant of

these relates to client participation in design, such as the author undertaking the initial keyboarding, scholars doing their own "graphics." The reduction in the mark-making aspect of designing is going to lead non-designers into thinking that there is nothing to it and that they can "do their own." Quite apart from this, the new technology is going to change the very structure of the design world since the most sophisticated facilities are not going to be available to all. This is an issue that has to be addressed both in global terms (the Third World) and in relation to small design practices in the industrialized world.

Roger: The process does change; the designer can focus on process and conceptual development. In a sense the removal of traditional hand skills which are now present in the equipment, speeds up the idea development process leaving no time-outs for mental rests. It also changes in terms of practical things such as faculty attitudes about buying into a more systematic approach.

Chuck: Considering just the graphic end of the design process, an obvious change is the ability to generate alternatives easily and revise them rapidly. The ease with which this can be done, incidentally, creates its own problems of how to select and direct the process of alteration effectively. Emphasis within the design process can shift to issues of meaning, concept, and purpose with major gains possible in the quality of the work.



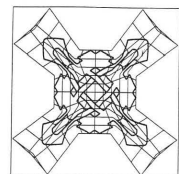
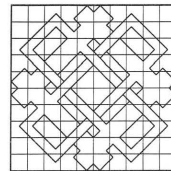
A "poster" program uses the computer utility as a printer. Gray scales are created by overprinting characters on a standard line printer. **IIT:** Poster, James Montague; Images, Charles Owen.

Michael: I'd like to take up the idea of "speeding up" raised by all of you. This has undoubted benefits of the kind you outline, but I also believe it presents some dangers. It seems to me that there is some value in having "gestation periods," that is, intervals between stages of designing to allow critical judgment to take place. Such stages often occur naturally in hand work, and are not at all inconsistent with this use of computers. But it may be necessary to build into design procedures stages that recognize the need for decisions to be taken in a more relaxed way. Ironically, the very fertility of computers in terms of throwing up variant approaches adds to the load (and probably slows down designing) at the decision-making stage.

I'd like to push further with these ideas. Can we equate quantity of experience—many quick images that we edit—with the quality of more slowly making careful visual decisions because we are well aware of the energy invested in the images?

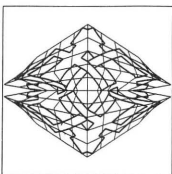
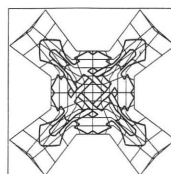
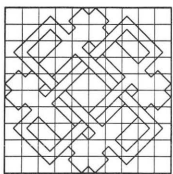
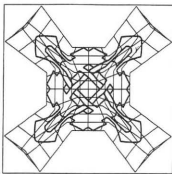
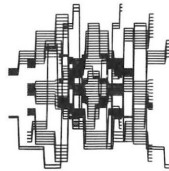
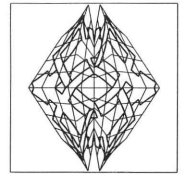
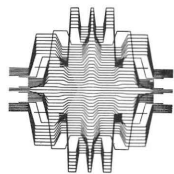
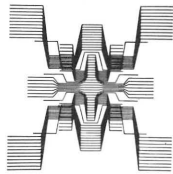
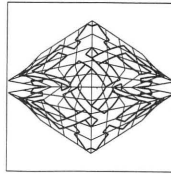
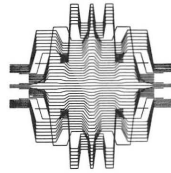
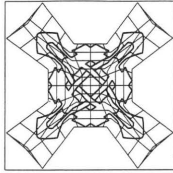
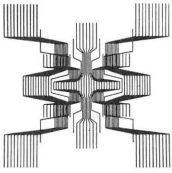
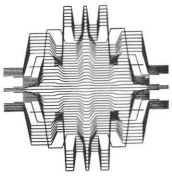
Chuck: We have both possibilities with a good computer system. On the one hand we can generate variations automatically, using algorithms to vary parameters (numbering in the hundreds for sophisticated form-generating procedures). Editing, in this case, is selection; but it could include subtle manipulation of parameters. On the other hand, visual editing systems that mimic or extend hand operations make it possible for the designer to take infinite pains in direct alteration of the image.

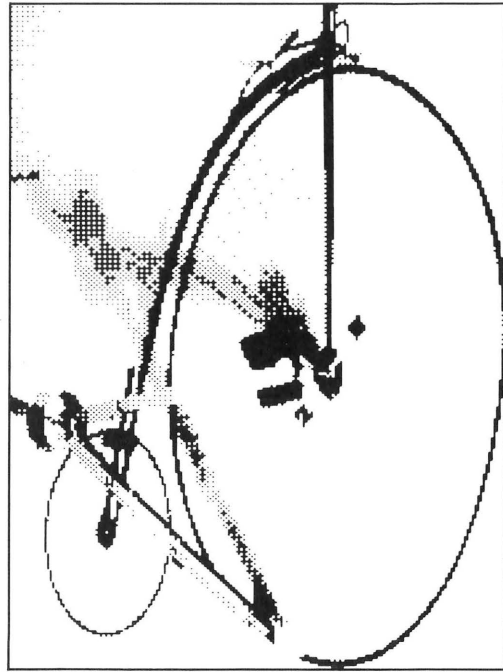
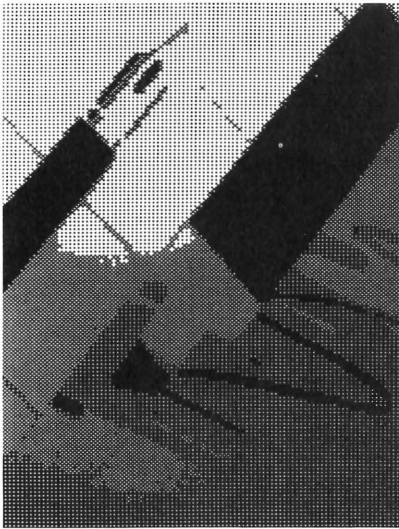
Maybe the issue really concerns the incubation that occurs when the process must extend over time. We tend to take all the time we can under any circumstance. Using a computer doesn't change the time I spend, but it does let me cover more possibilities and work with them in greater depth. If I have more time, I usually gain greater insight, and the ability to generate variations tends to prevent fixation.



Subtle manipulations of two images using Deform.
IIT: Charles Owen.

Michael: Speed may well be an advantage at the exploring of alternative stage of design, but consideration of alternatives and decision-making take time and will often involve getting reactions of the target audience. This stage is not at all conducive to speeding up, though there will clearly be a temptation to apply the same notions of efficiency to it as to the exploring of alternative stage.





A video signal was used as input and manipulated.
RIT: Robert Keough, instructor.

**What new sensibilities
does a designer need?**

Roger: Visually, none. Concepts of organization remain the same. Existing problemsolving skills need to be sharpened....Certainly an openness to technology and what it can and cannot do is important. The designer must be able to outthink the designated function of software.

Michael: Designers will probably need better developed visual sensibilities. The reason for saying this is that they will have to make visual judgments without quite the same support as they have had in the past from "traditional values." Experience has shown that appalling decisions can be taken by people with computing and related skills who do not have their visual sensitivities sufficiently well developed.

Chuck: There are some good analogies here to what designers have been faced with through the development of photography and even the general explosion of materials made possible by modern materials sci-

ence. When anyone can "take a picture," what makes a good photograph? When you have a wealth of materials to choose from, what is the "right" material? What is the proper form for plastic? We have already seen the endless, eye-watering bombardment of "computer art"—still so apparently awe-inspiring that no one has had the nerve to ask the obvious questions: is it art? Is it good? Designers are, once again, going to have to look deeply to what determines good design. Sensibilities are developed through deep knowledge; the ability to judge resides in experience enlightened by the insight of understanding. Because it will be so easy to generate images without thought, it will be a thousand times more important to be able to "de-generate" them with thought.

Michael, would you agree that computer limitations begin to function as value limits and that without visual training the user accepts these limits rather than search for a new approach or a more refined manipulation of what is presented?

Michael: Yes. I have made the assumption that present constraints in computer use impose "value limits" as you call them that are different from the "value limits" of traditional communication technologies. Our sensibilities when using traditional technologies have been shaped by years of experience (both individual and collective). In the field of computing, visual judgments will have to be made in relation to issues for which there are no real precedents and no accepted values. In my view, only someone with well-developed visual sensitivities will have the understanding and confidence to challenge and to change "value limits" in order to improve graphic communication.

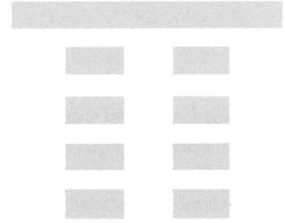
Do you think the computer and its graphic capability are compatible with virtually any visual communication problem? Will it replace the traditional drawing board and hand skill operations?

Roger: Yes, virtually any visual communication will be programmable and eventually it will replace traditional operations, i.e., technical skills, but it will never replace the creative dimension.

The computer has a tremendous value as a production tool. Methodologically speaking, our undergraduate program will need to be reshaped to coincide with this opportunity. In a few years, with the availability of computers growing (in reference to demand and price decrease), a majority of the public will have computers. Seven or eight years ago microcomputers were barely hitting the market and today, with the capabilities of the MacIntosh, it is hard to predict what the next ten years will be like, particularly given the interest in artificial intelligence and the decrease in cost.

Michael: We are running a three-year British Library-funded project on this particular issue as it relates to what we call verbal graphic language. In short the answer is not yes but no! At the moment the lack of characters (foreign and other sorts) and alphabetic variants (italics and bolds) is a distinct drawback, so too is the inflexibility in spacing and the low resolution of most systems. No doubt all these problems will become less acute as the technology improves, but I imagine there will still be the overriding problem of inflexibility of format.

Sample from an alphabet for use in Greek word processing. **Reading:** Pauline Key-Kairis, Lecturer.



Τώρα πρέπει να δούμε πως είναι
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γράμματα όταν ετοιχαιοθετούμε
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I do not believe—and I write this sitting in the garden—that traditional handwriting or drawing skills will disappear. Apart from anything else, there will be the very natural human desire for variety and, rather less worthy, a nostalgia factor. There already seems to be evidence of a “campaign for real writing” both in America and the UK. But of course there is going to be much greater use of computers in relation to ordinary communication.

Chuck: It is hard to say anything so absolute as “the computer will replace all interactive graphic media,” but there is clear evidence in the developments of the last twenty years that we will be able to do many graphic tasks with computer help—and do them better than before. Certainly, the pencil and pad in a conducive environment will remain the medium of choice for “of the moment” concepts and idea transfers over lunch... The computer systems will have their major impact where other structured processes now exist—the drawing board and work table certainly are easy targets. The most challenging (and interesting) applications for the design professions will be those where the computer can interpret, suggest, discuss, and otherwise act as an intelligent assistant in the early formation stages of concept development.

It would be a mistake to underestimate the ability of the computer graphics industry to improve quality in image. We can expect super-fast processors and enormous memories within the next few years—and at accessible prices. Monitor resolutions are already available at the 2000 by 2000 level and higher quality output devices appear every year. The question for quality is only “when?”.

Michael: It is important to distinguish between the originators of graphic messages and the recipients of them when answering this question.

The computer is probably going to be very effective in relation to the former—though sometimes at a cost. The cost may be fully offset by other advantages arising from the computer’s facility to do other things, but this will not always be the case. And though the argument that costs will continue to come down is a fair one, I find it hard to imagine a world in which computer costs will come down to such an extent as to be competitive with pencil and paper.

As far as the recipients of messages are concerned, it is not simply a matter of costs. Until some-

thing of the flexibility of the book is achieved on screen I cannot see many traditional carriers of information being discarded. The codex is an exceedingly flexible device that allows for a good overview of its content and speedy access to any part of its database through effective contents lists, indexes, and so forth. No amount of "windowing" will give such flexibility. Furthermore, the whole issue of the use of computers has to be seen in much wider terms. I happen to believe that the hand skills involved in drawing and writing in longhand are valuable generally in an educational sense. What better way is there to teach certain skills and coordination of hand and eye?

Will hand skills be diminished and does this relate in any way to lower visual standards?

Chuck: Hand skills will be diminished. Nobody likes to produce badly crafted work when, but for a change of tool, the work could be well crafted. I think that we have to ask what the fundamentals really are. If hand skills are necessary to develop mind skills and sensitivity, then they are truly fundamental. If they simply represent the tools of the trade, they should be replaced with better tools when these become available.

We admire the craftsman for what he is able to accomplish within the limitations of his tools. We admire the designer for what he is able to accomplish, period.

I am not sure what that means in the long run. There is a special learning activity that takes place in working directly with simple materials and media—we use that premise in our foundation program. If, as we assume, the understanding of subtlety and nuance develops most surely from direct experience, then we may have problems. This is an area where research could be helpful. After all, what we really are after is the inventive mind and the discerning eye. If we can't develop these without extensive hand skills training, we need to know it.

Michael: I believe hand skills are fundamental to *all* learning. Things can be experienced through the development of hand skills that cannot be learned so effectively in any other way. We shall certainly aim to keep such activities going in our institution, but we may have to recognize that they are going to be less important in some areas of professional design.

Are there inherent limitations in the visual character of computer-generated images? If so, what?



Michael: Of course, I believe this will always be so. It is so with printing even after 500 years, and I can't see it will be any different with computer-generated images. Any output device imposes constraints in terms of resolution, luminosity, colour, etc. However good the technology, it is reasonable to assume that there will always be a need for quicker and cheaper forms of it. Newspapers could be printed in fine screen litho on good quality paper, but they are not precisely for these reasons.

Roger: Size and screen resolution together with color limitations are very real. However, hard copy in the future will be indistinguishable from traditional means.

Chuck: There is no theoretical limitation to the character of computer-generated images that I am aware of. In the last ten years we have seen major strides in the development of algorithms to render lighted scenes accurately. Last year, for example, saw papers published on penumbras, umbras, motion blurring, and new procedures for "growing" grass, mountains, and other natural features. Besides increasing sophistication in processes for constructing nonexistent environments, there are quality increases in techniques for entering data directly: better "paint" processes, improved scanning processes for digitizing data directly from the world of graphic representations. Output quality has also improved as a result of hardware with greater screen resolution and algorithms for smoothing edges that otherwise might appear "stair-stepped." Considering what is already available, it is hard to imagine any ultimate limitation. What is difficult or expensive today will very likely be easy and cost competitive tomorrow—that has been our experience and there is no reason to suggest otherwise. If anything, we have been conservative in predicting progress.

Have you identified any change in formal visual considerations with computer graphics?

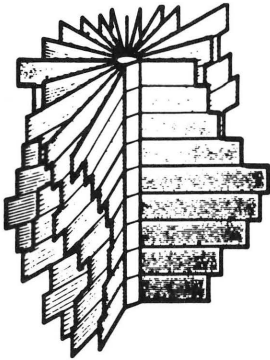
Roger: Yes, coarseness; the designer must work to use this built-in deficiency in the imagery. The designer must take into account the screen size, number of colors available, and light conditions; all of these have impact on message and receiver. Also, the component of time which is much stronger with computer equipment—things are occurring over time as an integral part; time becomes a design element.

Chuck: Disregarding the proliferation of “computer art” represented by spirograph clones and manipulated video noise, there seems to be a distinct turn to complexity in the selection and rendering of images. This probably mirrors the new opportunities possible in the development of design processes. Because it is now possible, it will be explored.

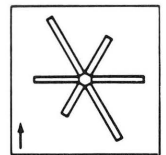
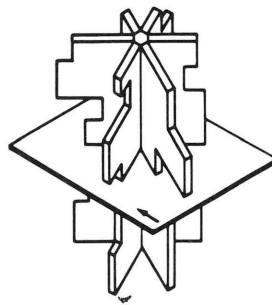
We’ve explored the visual process relationships but there is also the information access and management issue as it relates to design process....

Chuck: Potentially, these are more far-reaching effects. Actually, the “graphic” part of design is a small part of the overall design process. The computer revolution will really begin to change design process as it develops more capability to act in “intelligent” ways to assist broadly across the entire spectrum of activities that go into planning, design, and development.

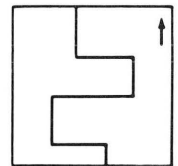
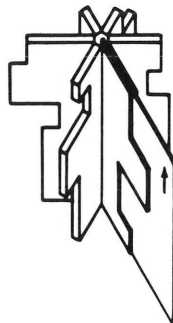
We see an immediate focus on the automation of handwork, then an extension of computer support to the thinking parts of the design process—as supports for information handling, analysis, pattern finding, and even conceptualization.



A computer graphic model for analyzing activities.
IIT: Kuohsiang Chen, MS thesis.



H. Section



V. Section

Michael: We have explored this issue with another party. The real problem arises from the fact that designers are not renowned for making use of the available literature of their subject, which means that it isn't possible to demonstrate that there is a market for a design database.



Have any of you thought about or do you know about any design data banks or design networks that are planned or have evolved to support creative interaction and easy access to design information?

Chuck: Many networks are too expensive for casual use. We did some talking with DEC and some other schools about setting up a network two years ago, but the costs as we saw them were too great. We are now considering "Usenet" as a possible low-cost way to network. As one of our Affiliate Group benefits we will begin development of a data bank that will be accessible by members. I don't know of any other design networks in existence or in the planning stage.

Specifically, how are you using the computer? As a creative tool? A production tool? A teaching tool? Other?

Michael: We are using the computer as a creative tool in relation to lettering (through a type design program) and for the design of pages of Prestel and Ceefax—and to a lesser extent for an electronic journal BLEND. It is used as a production tool at a modest level (word processing and interfacing with a photocomposition machine), and through direct links with the institution's mainframe computer and by communication with an external photocomposition service. It is also being used in connection with research statistics and as a means of introducing students to the organization of verbal graphic language.

Roger: We are primarily using it as a creative tool and also for training in career opportunities. In terms of the Genigraphics (as a creative tool), we have gone beyond its original purpose as a slide production system; we are using it for layouts of all kinds, as an idea generator, for information design and medical illustration within the contexts of package, product, and graphic design.

Chuck: We aren't using the computer as a teaching tool, although we have some masters' thesis work in progress on topics of computer-aided instruction. Typesetting is done by computer and all thesis project

report word processing is done on computers. Computers are used for information handling in the research stages of projects, and computer graphics programs are used to generate patterns and transformations in design classes. A three-dimensional program is used in the technical drawing class to work with perspective and other viewing conventions. In the computer graphics class, graphic programs are the subject, with student work focused on learning to program well enough to be able to write their own application packages. In a course devoted to control technology, students learn microprocessor programming and actually design control applications—writing machine language programs and breadboarding the electronics for sensors and actuators. Most masters' level theses include sophisticated applications programs.

While we offer the opportunity for extensive involvement with computer graphics, it would be very unlikely that we would offer a degree with that title. Since we view computer graphics as a part of the designer's tool kit, we see its study as associated with that of other tools for design. Computer-supported design, for example, is a higher level concept which includes computer graphics as well as other means for using computers in design.

Some design teaching is inefficient from a faculty-use standpoint because some course work such as visual training, once introduced, needs to be pursued on an individual basis. For example, letterspacing needs to be internalized through experience and observation, as do color studies.

At the University of Delaware, I've seen a letterspacing program used as visual sensitivity training; likewise at Brown University, I've seen an Albers-like color study program used for visual training.

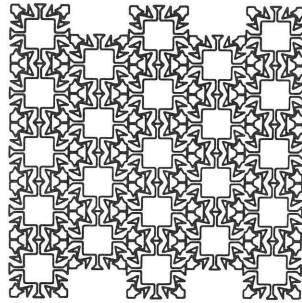
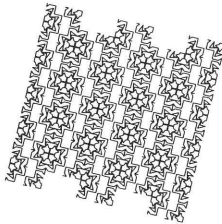
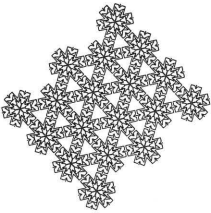
Are you using or do you intend to design supplementary visual or intellectual skill drills using the computer?

Michael: Our character design programme is useful from this point of view. In a somewhat different vein, we have just been wired up with a local area network and are now using this for notices and messages, and are toying with the idea of using it for timetables, simply to involve students more with terminals on an everyday basis for accessing information.

Chuck: We aren't using the computer for skill drills, but have written programs that can be used to create



certain kinds of graphic construction. A program called Mosaic, for example, can create patterns that use the symmetry operations of rotation, reflection, and translation, and can work within square, triangular, and hexagonal tessellation fields. In the basic two-dimensional design class, this program can be used to experiment with the nature of pattern. Other programs do other things—transforming one form into another, or “growing” complex organic forms from form elements, for example. The speed with which the image is generated lets the student go through extensive experimental explorations that would simply not be possible with drawing or collage techniques.



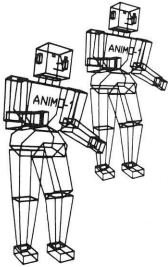
Patterns created from a single element using Mosaic. **IIT:** Huver Hu.

How do you introduce computer graphics to your students?

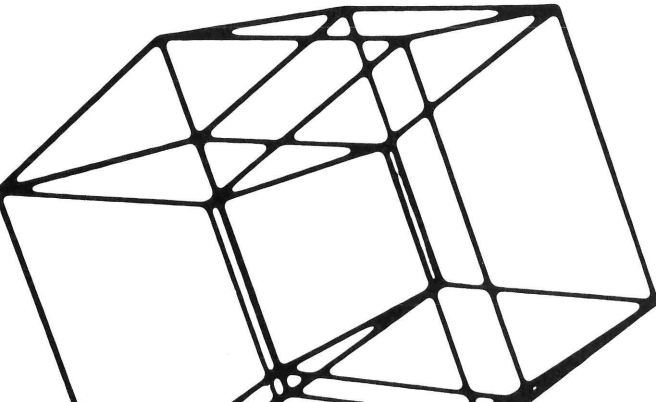
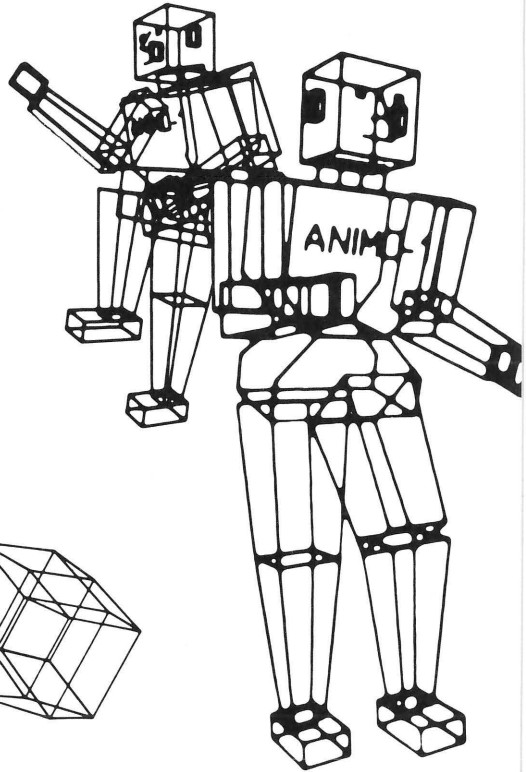
Michael: We are just moving into a new phase in our teaching of computing and our arrangements are a little uncertain. In the past, first-year students have been introduced to our Prestel simulator and have designed simple pages of information on the screen. Now that we've our own local network, students will be required to spend more time doing similar things by using typographically low-level terminals. We have sufficient terminals to make this a class-based activity. These first-year students will receive instruction in programming as a by-product of this experience. We now integrate computer studies with our other teaching.

Roger: We provide orientation and demonstration programs. Computer graphics is part of the foundation program.

Chuck: Computer graphics are introduced in the second semester in projects taught as part of the technical drawing class and the basic two-dimensional design class. Students take a computer programming course in the first semester along with the first class of a two-semester trigonometry, analytic geometry, calculus sequence, so some of the theoretical elements have been discussed and all students are familiar with the esoterics of talking to computer equipment. In the third year, students can take an elective course in computer graphics that concentrates on graphic programming.



An animated robot. **IIT:** Manlai You.



Three-dimensional projections of a four-dimensional cube rotating in four-dimensional space. **IIT:** Benoist Aulanier.

Are there any dangers (visual or intellectual) in the introduction of the computer as a design tool?

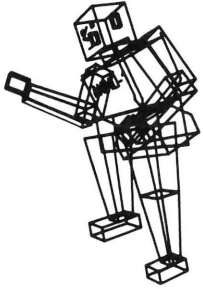
Roger: None. The means are out there for making visual swill with the computer as well as with other imaging tools.

Michael: The dangers are more human than visual or intellectual. The repetitive nature of data capture can't be particularly good for people, particularly when done over long periods. This aspect of computing might prove to be as damaging to the human spirit as production-line manufacture. I suppose the use of computers as a design tool might make us lazy in some respects, but it ought also to take us into challenging new areas and make us more able to make the right decisions.

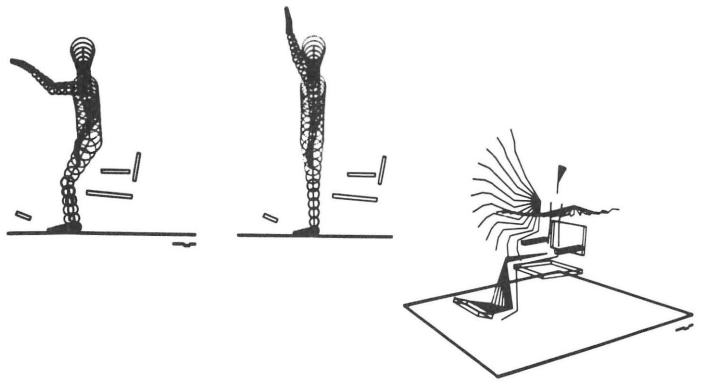
Chuck: Sure. There is always the danger of taking your tools too seriously. I always have some students who come to my class with the certainty that there is nothing that the computer can do for them (they are creative and computers are not). I have to worry about trying to show them that in fact, there are things they can do better with computers. But a much more dangerous student is the one who is prepared to embrace the computer as the tool that will automatically solve his problems. The seduction of the system is that it is precise; with precision comes a lulling of the senses and subconscious surrender to authority. Perhaps, there is a moral here for the program designer—design it to be tentative!

Roger: We are working on interesting and diverse projects: a feedback system that measures physiological response to be applied to understanding visual response, digital typography, interactive graphics programs, also video text and database design, animation, telecommunicating typography, and some experimental instructional programs.

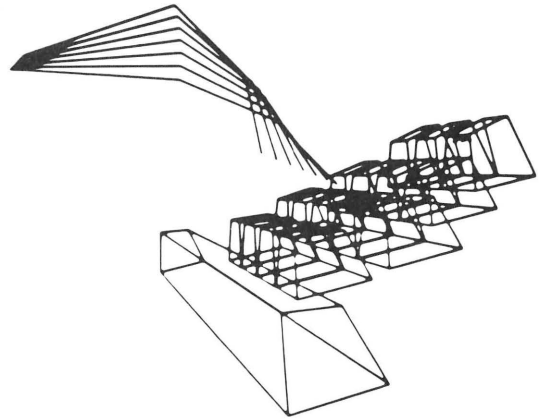
Michael: The only true research at present is related to the British Library—funded project mentioned earlier. This is a three-year project that is looking at what we call the “graphic translatability of text.” It's concerned with problems associated with the “translation” of messages designed for one system of production into forms that are appropriate for another system, usually a less sophisticated one. In short, it addresses the ques-



What kinds of research and experimentation related to computer graphics are going on among your faculty and students?



A computer graphic man-model developed to show human differences and their effects on product designs. **IIT:** Alonso Miranda, MS thesis.



tion, "Can the new methods used for verbal graphic language cope successfully with all such communication requirements?" The project falls into three parts: 1) a study of case histories in which problems have arisen; 2) the development of methods of document analysis that seek to identify the characteristics of different kinds of verbal graphic language; 3) testing alternative methods of presenting information on screen and paper.

Chuck: Master's level research very often includes the use of computer graphics or takes an area of it as a research topic. Recent theses include: a study of a means for analyzing complex activities that uses a diagrammatic model to assemble and display information on individual and/or group activities as they change over time; a data base model for human factors

information that includes both qualitative and quantitative data and can drive a computer graphic program to provide properly proportioned human figures (using specified anthropomorphic data) for incorporation in a product design test setting; a composition system for working in time with typographic and pictorial elements of dynamic computer graphic presentations; a simulation system for man modeling that allows specific human dimensions to be used and physical disabilities to be represented dynamically; a project planning process for controlling complex design processes involving many designers and different computer graphic design tools; an exploration of "cellular" concepts for rendering solid forms in computer graphics; and a gestural language model for controlling computer-aided design activity by a combination of voice and hand gestures. A major faculty research focus is the "Walter" project mentioned earlier.

Fig. A

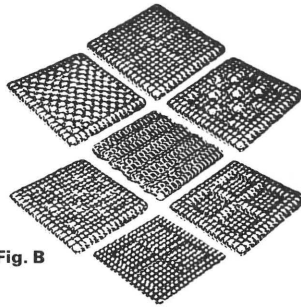
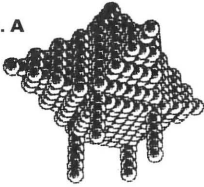


Fig. B

Cellular solids modeling. Experimental forms created in low resolution from assembled pyramid primitives (Fig. A), textures possible at a micro level (Fig. B), and higher resolution forms made with 7,000 cells (Fig. C). **IT:** Michen Chang, MS thesis.

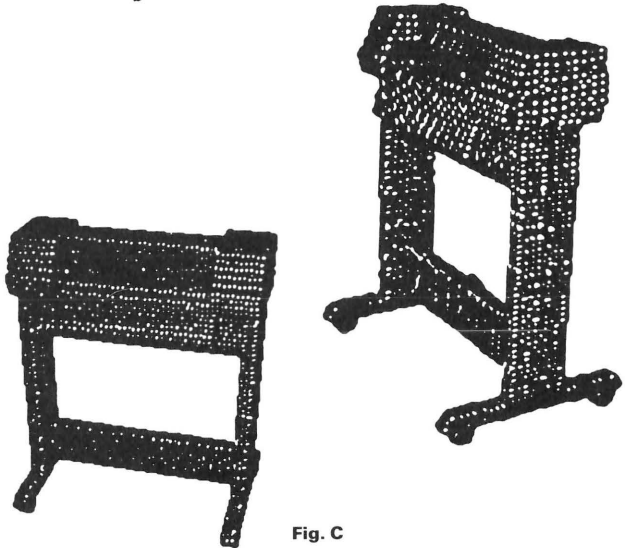


Fig. C

Are you doing any work on type design or the integration of type and image?

Chuck: Dynamic Information Display examines this in that both type and image are elements of composition in time. In recent consulting work, I developed an integrated typographic model for a computerized type drawing system. The theoretical work integrated weight changes, condensed and extended forms, letter spacing, x-height changes, and width changes with type size. The system specifies a model for digitizing letters and procedures for varying letterforms automatically.

Michael: At a theoretical level the relationship of text and image work station interests us a great deal and has been the subject of research in the Department. Currently we can integrate type and image, but only at the level of Prestel, Ceefax, and BLEND. Two or three members of staff use computers in relation to their research. One, who has recently completed her PhD, used statistical packages in her analysis of graphic language conventions; so too did staff members who investigated the use of multivariate techniques for analyzing features on forms. Our Forms Information Centre also uses computers, especially a relational database for information about forms. Two research students make use of computers. One makes considerable use of a microcomputer for the analysis of data about publications in connection with his research into aspects of seventeenth-century type design. Another (the Project Officer of the British Library—funded project on graphic translatability of text) uses computer-based information systems since they are central to this research.

Roger: We're working on integrating type and image on Genographics and Artronic Systems and also on the Apple. Faculty is using the Apple for digital type design and we have one recently completed thesis on the same topic.

Project yourselves five years into the future. If money were no object, how would you expand your computer graphic program?

Chuck: I would like to increase ease of access for students. Ideally, this would mean high-quality graphic terminals located, if not at each student's work station, then somewhere close by. Hard copy output could still be centralized (no one has unlimited funds!). The class

structure would not change radically in this format. Students would still learn more detailed uses (graphics programming) in higher level classes, as they do now.

There is always a shortage of work stations—computer graphic work stations are not like lathes or stat machines. If they are being used well, they can be used for many kinds of design activities and are more like personal equipment than laboratory devices. The quality of the system and its vintage are important. A new system is always capable of doing much more than an old one—as opposed to other kinds of equipment that are, perhaps, somewhat better than earlier models, but not radically different. These issues are the primary ones affecting the implementation of computer graphics programs, and both are resolved with a big money bag.

On another level, it is frustrating to see excellent research in theses fail to reach the level of finish sufficient to allow them to be used in the field. The difference between a demonstration program and one tested for distribution is so great that a student cannot be asked to take the additional time required. What is necessary is a full-time development group that can do the extra programming and testing—we would like to expand our efforts here and hope to do so with funds from our Industry Affiliates Group.

Roger: We'd certainly like more hardware at all levels, terminals for all students in class, more interactive videodisc capability, and the ability to send and receive anywhere in the USA and world.

Michael: All students would have their own personal computers on their desks, along with high-resolution terminals. What I'm not sure of is how much use students would make of them—or indeed how much use I would want students to make of them.

What does the future hold and how far away is it?

Chuck: The best predictions to make are those far enough away to ensure you won't be here to answer for them. That said, I'll ignore my own advice and say that low-cost, high-quality graphic systems are very close—that within five years we will see a great deal of design done with computer assistance. This is a long step away from today's situation. Crucial to the change will be the quality of software. That is the weakest part of my prediction. If there is a substantial development of research by designers in the software areas, the

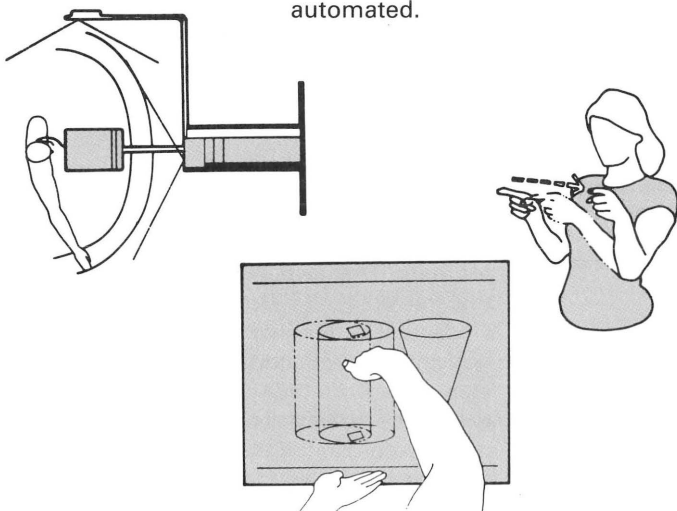
prediction will be very solid. If not, the change will still take place, but much more tentatively as designers make do with software done for them by others who really don't have the insight required.

Michael: It seems quite clear that graphic design (up till now the preserve of the professional) will be opened up to the lay community as a result of the widespread introduction of computing. And it follows from this that graphic language will develop more as spoken language has developed, that is, more in direct response to the spirit of the times. The use of voice input devices may well strengthen this relationship.

The authority/control/influence of the producers and distributors of graphic language (traditionally the publisher and printer) will therefore lessen or disappear. This will have all sorts of interesting social implications that I can't go into here.

What ideas and experiences, short of hands-on computer experience, can help graphic design students prepare for the future?

Chuck: The computer places a premium on the ability to think. Designers who do repetitive work that could be automated will find themselves out of work. The best service that design schools can perform for their students is to teach them design as problemsolving/project finding. While traditional design skills are important, they will become more important in the future as formative experiences than as primary job skills. The ability to think out a graphic problem as a problem of communication requiring insight, invention, and, perhaps, the integration of other disciplines cannot be automated.



A gestural communication interface for controlling model development in computer-aided design. Cameras in the workstation enable the computer to recognize the location of the designer's hands in three dimensions; voice commands and gestures control the form-making process. **IIT:** Christopher Nemeth, MS thesis.

Michael: There is no real substitute for hands-on experience. We have organized courses of lectures on computers for nearly fifteen years, but the real understanding only dawns as students become involved with computer facilities within the department. Nevertheless, I feel some overview in the form of theoretical classes is still needed. Other approaches to learning, exhibitions, demonstrations, and above all, reading journals, are useful.



What should graphic designers do to influence how computer graphics possibilities develop?

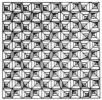
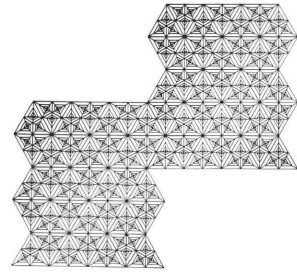
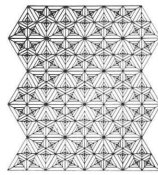
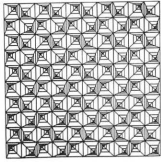
Michael: I wish I knew. Over the last ten or more years I have spent a considerable amount of time trying to explain to computer folk why I believe the typographic designer has an important role to play in computing as it relates to communication... I wish I had been more effective. Only now does the computer world seem to be waking up to the fact that messages need to be designed if they are to be effective.

What we have to do is quite simple. We need to come to terms with whatever technology is around or projected in order to influence its development and use. At the other end, we have to educate ordinary people to be able to discriminate between graphically literate and graphically illiterate messages so that they can influence the course of events. Since most manufacturers still seem to think they can do without the skills of typographic and graphic designers, I suspect the public lobby is going to prove the more effective of the two approaches.



Roger: Graphic designers must deal with software developers and provide an understanding of design needs. Professionally, the AIGA (American Institute of Graphic Arts) should get closer to the computer industry. AIGA seems stuck on its print heritage. As we establish consulting opportunities, and place our students in computer positions, we have impact by infiltrating their ranks and by enhancing design credibility in the long run.

Chuck: We must get involved. The computer graphic hardware companies just discovered design a few years ago (they actually are not sure yet what the difference between an artist and a designer is). By becoming involved in developing graphic programs and working with those who incorporate graphic standards in programs, designers can have a major influence on the

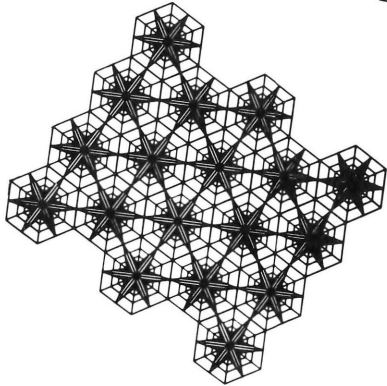
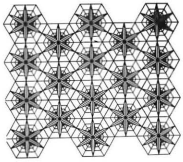
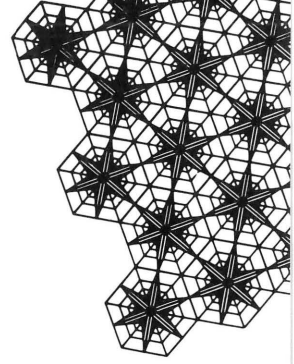
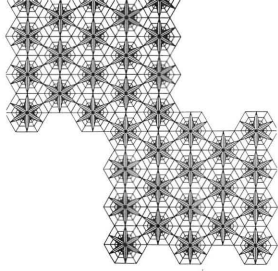


way computer graphics evolve. This may mean more education for some. Learning to program takes longer than learning to use a system, but both are short-term tasks. Graduate design programs are beginning to offer opportunities for those interested in working with computers—this may be the most direct road for those willing to spend the time.

Ultimately, though, to influence you must communicate. Designers must begin to participate in the journals and conferences that deal with computer graphics. The Association for Computing Machinery (ACM) sponsors a conference annually through its special interest group for computer graphics (SIG-GRAPH), and the National Computer Graphics Association (NCGA) also has an annual conference. These are the two largest (and most prestigious) conferences; other associations also have special computer graphic sessions in their conferences. Both NCGA and ACM have journals also, and a number of journals and trade magazines now are published solely for those interested in computer graphics.

Michael has suggested that the designer's sphere of influence may diminish as a result of the new technology. As this conversation comes to its end, please comment on how graphic design can redefine itself in order to preserve and perhaps extend its influence on visual communication.

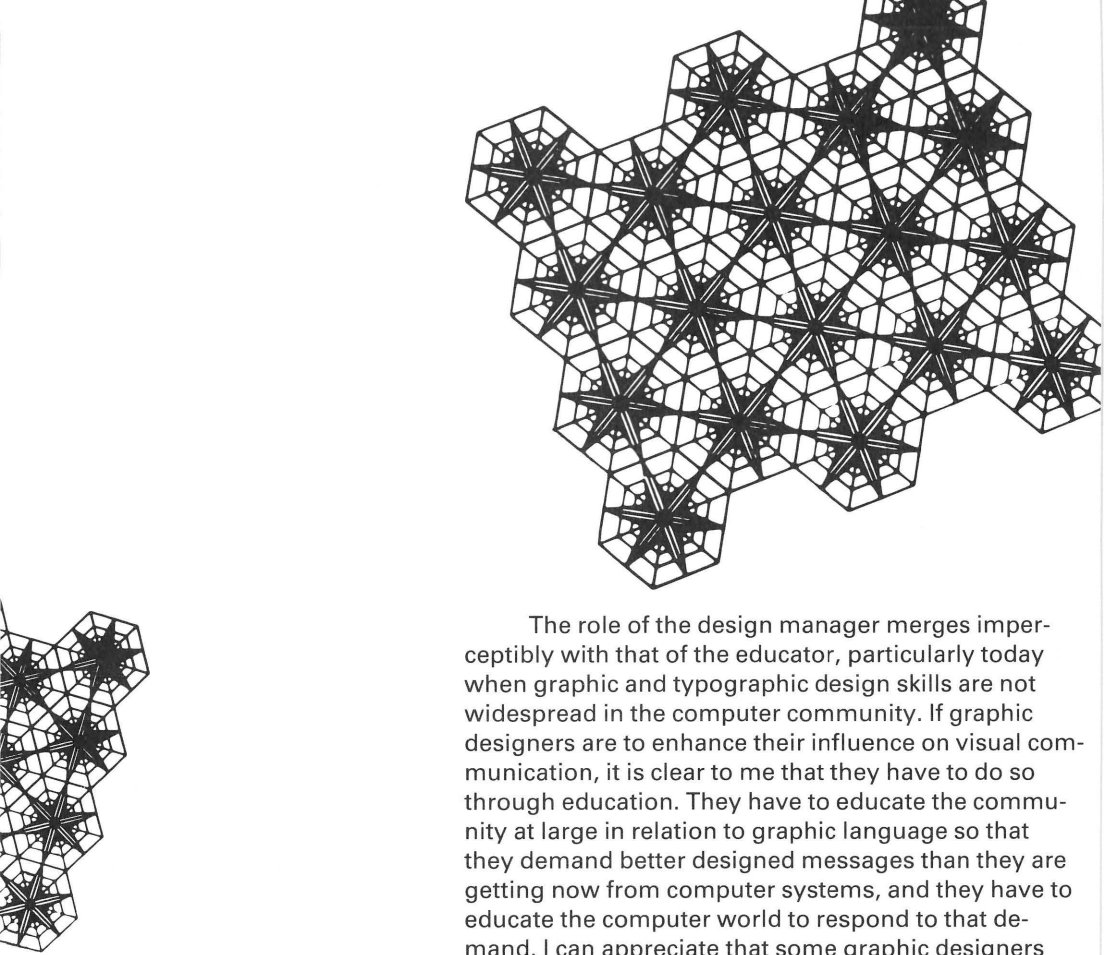
Michael: I didn't mean to imply that the designer's influence will diminish, merely that his role will change. If graphic language does develop more along the lines of spoken language, then clearly the designer's role will be lessened at the level of the individual message; an originator's involvement with computer graphics and initial capturing of text must lead to



Mosaic patterns. **IIT**: Soon-Jong Lee.

a lessening of the designer's involvement at this level. However, I think it is likely—and certainly to be desired—that designers will become much more involved when whole message systems are devised. I have in mind the design of graphic systems in which broad approaches to the design of messages are established, covering such things as the treatment of verbal and pictorial language. Such broad approaches would need to be established (preferably in connection with, or in light of, national and international standards) if communication is not to break down under the strain of individual variations resulting from the greater graphic power given to individual communicators.

In such a scenario the graphic designer would be less involved with the design of "one off" messages and more concerned with overall "graphic frameworks." In many instances, he would lose responsibility for making detailed decisions about particular messages. And this might present problems for those designers who like to have total responsibility for the design of assignments they work on. On the other hand, it seems clear that the involvement of the designer with "graphic frameworks" will lead to a need for a broadening of design skills to include management and editorial skills.

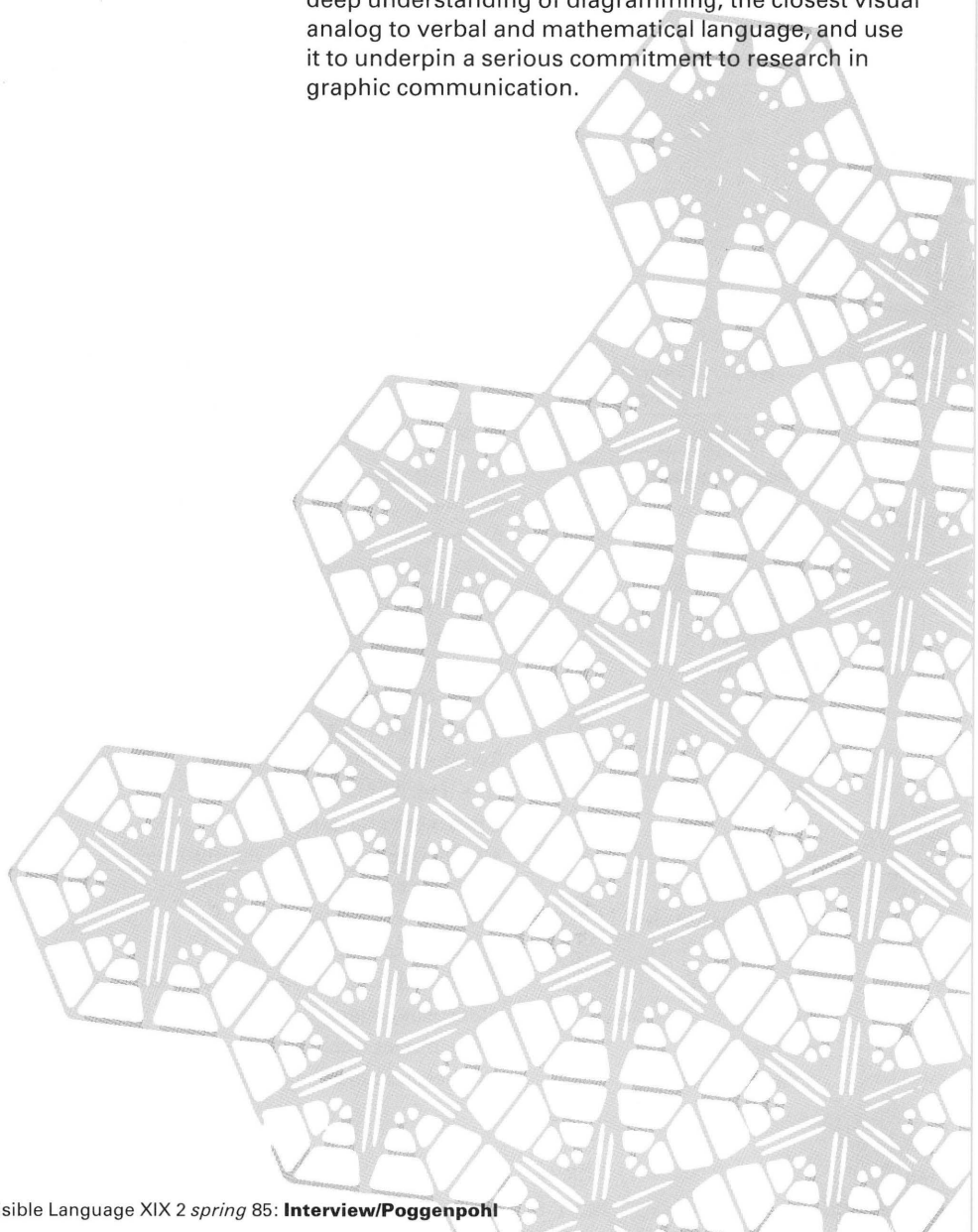


The role of the design manager merges imperceptibly with that of the educator, particularly today when graphic and typographic design skills are not widespread in the computer community. If graphic designers are to enhance their influence on visual communication, it is clear to me that they have to do so through education. They have to educate the community at large in relation to graphic language so that they demand better designed messages than they are getting now from computer systems, and they have to educate the computer world to respond to that demand. I can appreciate that some graphic designers will see a professional risk in all this, but I don't believe they should feel threatened by such a proliferation of design understanding. A good graphic or typographic designer will always be able to contribute something of value to the transformation of messages so as to make them more effective for others to use.

Chuck: I have a vision of monks all across Europe closing up their inkstands and going off to the fields as the news of the Gutenberg press passes from town to town....we have to remember that the problems of graphic communication transcend any specific media. In fact, the advent of computer graphic processes and the new channels of communication that are appropriate for them raise more questions than they answer.

To the extent that graphic design is a hand skill, it will be replaced. To the extent that it can be taught as a set of rules, the rules will be incorporated in expert

systems. There will always be graphic design artisans—just as there are still a few craftsmen who can do fine hand lettering—but the future for graphic design is on the high road of visual communication. This means designing the rule systems instead of using them, designing systems of communication instead of individual communication pieces. It means greater involvement with the ideas of visual language, finding ways to raise visual communication, to use an analogy, from the equivalent of primitive speech to that of literature. Quite probably, this means that we must develop a deep understanding of diagramming, the closest visual analog to verbal and mathematical language, and use it to underpin a serious commitment to research in graphic communication.



● **Rochester Institute of Technology**

Hardware

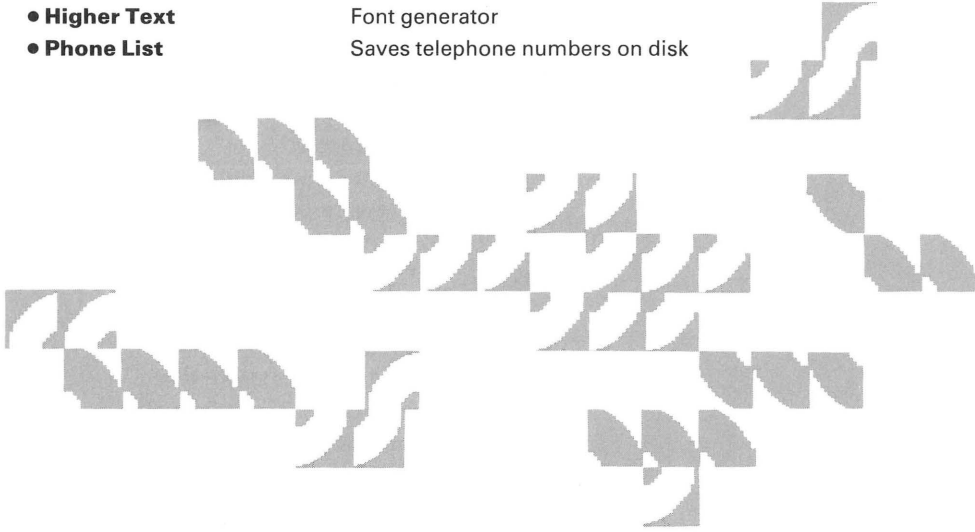
	Quantity/Type
	1 Genigraphics 100C
	8 Artron 2000 Units Image Grabber Slide Recorder and Polaroid Film Recorder
	11 Apple II+ and IIe Units with Disc Drives, Monitors, Joysticks, or Tablets
	1 Image Grabber
	3 Epson Printers
	1 Tektronics Plotter
	2 Apple Plotters
	3 GIGI Terminals
	6 Dec Pro-350 Units
	1 Omni-tec 2000 Typesetter with 3 Workstations
	3 Autographics Units

Software

Key ○ Commercial
 ● Homegrown

Name/Origin	Functional Description
○ Micro Illustrator	2-D image generation
○ A2-3D1	3-D image generation
○ Take 1	Animation
○ Image Printer	Screen dump program
● Draw	Sketch using tablet
● Display	Displays images on disk
● Preview	Displays data on disk
● Input	Shape creation numerically
● Trans	Shape transformation
● Symtex	Symbol and visual texture
● Intervals	Line interval creation
● Grid	Grids, copyfitting, layout
● Type	Manipulate and modify letterforms
● Body copy	Indicates copy with parallel lines
● Quadrasketch	Symmetric shape creation
● Gridplot	Full-scale grid plotting
● Shapeplot	Plots shapes from Symtex, Input, and Type programs
● Inplot	Plots using Intervals
● Screenplot	Plots images from Display
● AndScreen	Logical and between 2 images

Name/Origin	Functional Description
● OrScreen	Logical or between 2 images
● Ldraw	Free-hand with light-pen
● Three-D	3-D image generation
● Make Text	Create text and save on disk
● Retrieve Text	Displays text from disk
● Higher Text	Font generator
● Phone List	Saves telephone numbers on disk



● **Illinois Institute of Technology**

Hardware

Unless specifically indicated, all the hardware listed here is on-site at the Institute of Design, available for student and faculty use through the Design Processes Laboratory.

	Quantity/Type
	1 Hewlett-Packard 1000F Computer
	1 Digital Equipment Corporation PDP 11/23 Computer
	4 Digital Equipment Corporation VT103 Microcomputers
	1 Digital Equipment Corporation VAX 11/780 (hardwired from another building)
	2 Digital Equipment Corporation VAX 11/750's (hardwired from another building)
	1 Prime 550 (hardwired from another building)
	5 Digital Equipment Corporation GIGI Microcomputers
	1 Hewlett-Packard HP 85 Microcomputer
	2 Compugraphic Phototypesetting Systems (with two text editing workstations)

Hardware

Quantity/Type

- 1 Hewlett-Packard 7970 Magnetic Tape Drive
- 1 Hewlett-Packard 120 Megabyte Disc Drive
- 3 Digital Equipment Corporation RL and RX02 Disc Drives
- 13 Hewlett-Packard 2700 Color Graphic Workstations
- 2 Hewlett-Packard 2648 Monochrome Graphic Terminals
- 1 Hewlett-Packard Alphanumeric Terminal
- 5 Amdek Color IV Monitors
- 2 Amdek Color I Monitors
- 1 Digital Equipment Corporation VT125 Graphic Terminal
- 2 Digital Equipment Corporation VT100 Alphanumeric Terminals
- 8 Digital Equipment Corporation VT52 Alphanumeric Terminals
- 1 Magnavox Orion 60 Plasma Screen Graphics Terminal with Touch Panel and Rear Screen Slide Projection
- 1 Hewlett-Packard Graphics Line Printer
- 1 Hewlett-Packard Letter-Quality Daisy Wheel Printer
- 1 Digital Equipment Corporation Desktop Graphic Printer
- 4 Digital Equipment Corporation Desktop Printers
- 5 Digital Equipment Corporation Decwriters
- 1 Hewlett-Packard Digitizer
- 1 Hewlett-Packard 9872 8-pen Plotter
- 1 Hewlett-Packard 7580 8-pen Plotter

Software

All applications work is done with programs written by faculty or students for the task at hand or for research (frequently thesis work). Some programs have been carried to a production level and are used in classes or for research. Following are some of these.

Key ○ Commercial
● Homegrown

Name/Origin

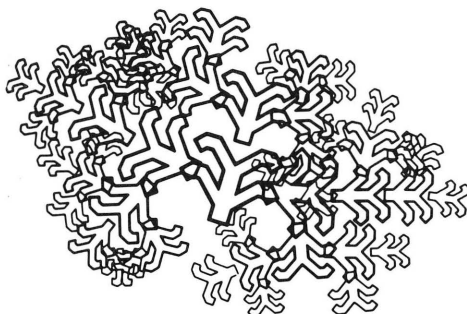
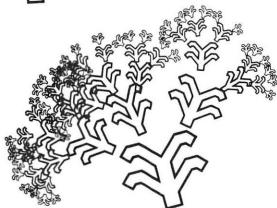
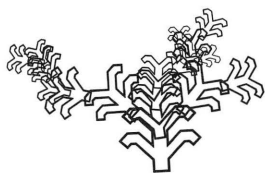
Functional Description

● **World**

Draws views of the earth. Perspective drawings of the globe are drawn from a viewpoint located above a point on the earth's longitude. The distance away from the earth can be specified, parallels and meridians can be drawn (or not) in specified frequency, and hidden lines can be removed or left in for a transparent world.



Name/Origin**Functional Description**

• Growth

Grows complex forms “organically” from an original image. The image is treated as a form (most approximately, a cactus), in that copies of itself can “grow” at bud points, and these in turn can have buds, etc. Control features allow the designer to select bud point positions, the number of buds, the number of growth seasons, and the “health” of the organism. The health of the organism is reflected in the perfection of replication. Less-than-healthy organisms have randomly distorted buds, angular variations in bud growth, and failure of some buds to reproduce.

• Resolv

Simplifies an image to fit progressively coarsened grids. A digitized image is drawn in the cells of a matrix where each cell has an imposed grid slightly coarser than the previous cell. The points of the image are forced to lie on the grid lines, and the resulting versions of the image are increasingly simplified as the number of grid lines in a cell decreases.

• Deform

Produces variations on an original image by the application of Cartesian transformations. An image is digitized in a grid and “operated on” by profile curves independently multiplying x and y coordinates.

• Xform

Transforms one given image to another. Original images may be placed anywhere in a two-dimensional field of square cells and appropriate transformations will be calculated and drawn with regard to each cell’s position relative to the given images. The field becomes an “animation matrix” with any path from one given image to the other recording the “in betweens” for that path.

• Mosaic

Creates two-dimensional patterns from an original image. A module is constructed from the image element by selecting rotations and/or reflections and filling a four-cell square. One image can be used to create patterns in all the regular tessellations of the plane and, with module variations using combinations of element rotations and reflections, can produce patterns of great variety.

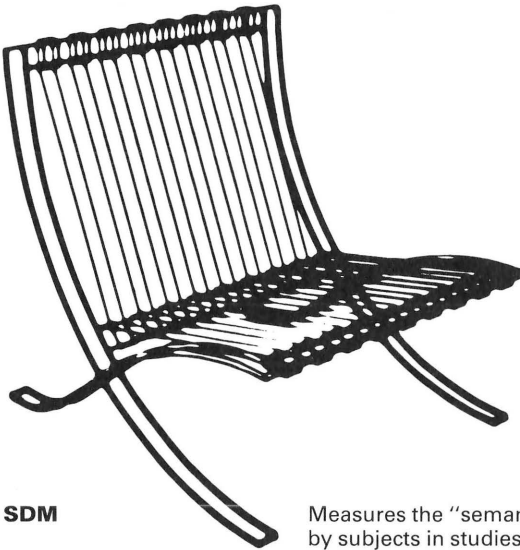
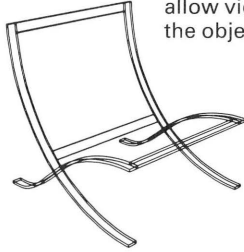
Software

Name/Origin

Functional Description

● **Graphx**

Draws wireframe views of three-dimensional objects and scenes. Entities are described as sets of lines from lists of lines and points entered to delineate all objects in a scene. Manipulations include rotations, translations, variable angle scaling (the effect of changing camera lenses), and various kinds of projections including perspective, orthographic, isometric, and stereo. Presentations may be constructed by drawing in sequence images that are "built up" by adding, subtracting, or switching entities. Windowing procedures allow views to be made from any position, outside or inside the object or scene.



● **SDM**

Measures the "semantic distance" between concepts rated by subjects in studies of perceived meaning. A recent program designed for the Magnavox Orion system shows concepts to subjects as slides rear-projected on the Magnavox plasma screen. Subjects rate concepts on bipolar scales like good-bad, ugly-beautiful, etc., using a touch panel on the screen. Accumulated data can be shown at any time as profiles comparing the concepts on the scales.

- **Relatn**
- **Vtcon**
- **Similar**

These are not graphic programs but programs designed to manage information, help structure complex problems, and assist the designer with complex problem-solving tasks.

