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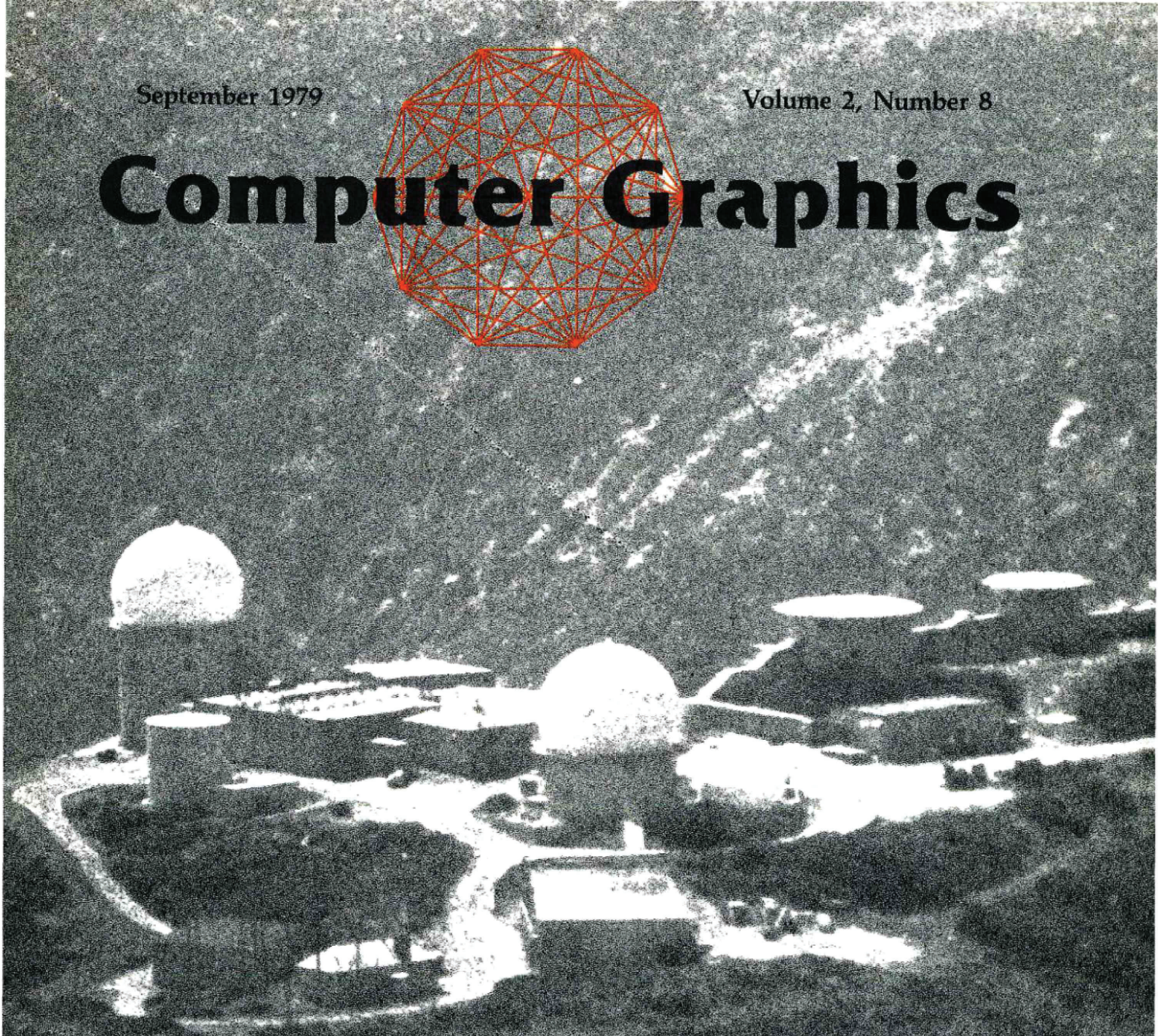
Computer Graphics



CG and The Energy Crisis

The Rules of the Game

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Today it's common knowledge that computers are getting smaller and more powerful for less money at an increasingly rapid rate. This trend began with the introduction of computers in 1946 and is not likely to peak before the end of this century. The end of this decade, however, is a particularly significant point, the turning point that will introduce a new technology into our society that will be with us a long time and will transform the way we do just about everything—the personal computer.

The personal computer means, of course, that more film and video artists will be working with computer animation, but beyond that exists the potential for transforming animation into a popular medium of expression like photography. Any discussion involving computers and art must be considered in this context. People in our society will be communicating via computer graphics in the next decade and beyond as easily as they use the telephone today.

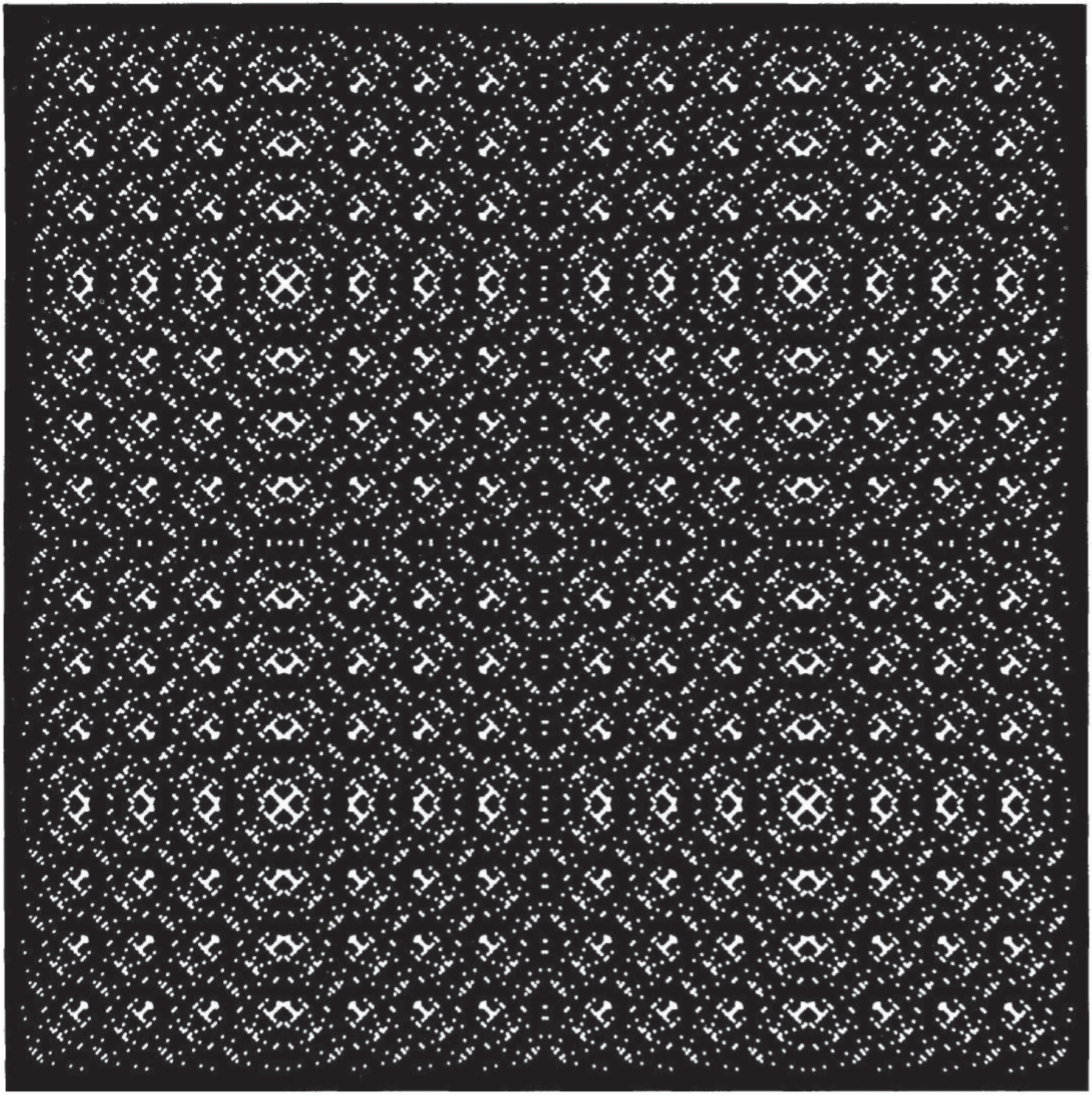
One hundred years ago it would have been difficult to imagine photography with its cumbersome wet-plate technology as anything but a medium for the professional and the die-hard enthusiast. In 1879, the dry-plate process made roll film and hand cameras possible which immediately transformed picture-taking into a kind of universal literacy. The effects of this transformation on art and society is incalculable. The introduction of the personal computer on a mass scale is sure to perform a similar transformation on the art of animation with equally massive and unpredictable repercussions.

How is this? The most useful approach is, as computer scientist Alan Kay suggests, to regard the personal computer as "the newest example of human mediums of communications. . . . their ability to simulate the details of any descriptive model means the computer, viewed as a medium, can simulate any other medium if the methods of simulation are sufficiently well described." The requirement that the methods of simulation be well described would indicate that our computer-simulation capabilities are a direct function of our descriptive abilities—which they are. In fact, the importance of language in determining our world view and what's even conceivable is well-known. Thus, a major concern of computer artists is the computer language in which their simulations can be expressed.

The word "simulation", however, may have some negative connotations (as it did when I was an undergraduate in architecture school). Using plastic, aluminum, and vinyl to simulate wood grain, leather, brick, etc. was phony and unnatural. But these simulations which function as substitutes of a desired reality, are fundamentally different from simulations which man uses to learn something about reality and about himself. For example, role playing in therapy and schoolroom contexts is used to simulate social situations to understand the viewpoint of others or to build skills like interviewing. In countless applications, computer simulation is used to learn something.

John Lilly, author of *Programming and Metaprogramming the Human Biocomputer,* called his book on the science of belief: *Simulations of God.* He describes how our belief systems determine our judgement of statements as "true" or "false." Then he introduces a second pair of logic values, the "as if true/false," which are used when we simulate a system. We use this simulation mode in choosing among alternative courses of action and their consequences. Also we use it when reading a novel or watching a movie. Afterwards we examine the simulations for their "real" value. That is, have we learned anything exciting, new, useful or profound by the "simulated experience?" In this sense, a simulation or model can be thought of as a script or scenario for use by oneself or others. Likewise, a script, (or novel or film or painting) can be considered a simulation—the artist's model of a reality for the audience to experience. Lilly's definition of "simulation" is identical to the computer scientist's. The relationship between modeling, scripts, and computers appears often, as in Joseph Weizenbaum's *Computer Power and Human Reason:* "An engineer is inextricably impacted in the material world. His creativity is confined by its laws. . . The computer programmer, however, is a creator of universes for which he alone is the lawgiver. So, of course, is the designer of any game. But universes of virtually unlimited complexity can be created in the form of computer programs. Moreover, and this is a crucial point, systems so formulated and elaborated act out their programmed scripts. They compliantly obey their laws and vividly exhibit their obedient behavior. No playwright, no stage director, no emperor, however powerful, has ever exercised such absolute authority to arrange a stage or a field of battle and to command such unswervingly dutiful actors or troops."

The scripts are programs written in computer languages. Traditionally, philosophers looking for the 'essence of man,' that quality which distinguishes him from all other species, usually cite tool-building as man's unique characteristic. The current consensus, however, is that man's use of symbolic language is not only unique but also an essential aspect of being human. Anatole Rapoport says that more can be learned about the nature of man by examining symbolic language and its role in human existence than from any other characteristic of man. The use of symbolic language is also universal, and as Kay reminds us, toolmaking historically has been the province of technological specialists: "Technologies frequently require special tech-



Illustrations: According to Group Therapy there are exactly seventeen symmetry groups of the plane. Each is defined by a set of transformations and designated according to an international notation system (pi. cm, p4mm, etc.). These illustrations were created by performing the transformations of one group upon a network pattern generated by a second group.

"p4mm series: pi"

niques, materials, tools, and physical conditions. An important property of computers, however, is that very general tools for using them can be built by anyone. These tools are made from the same materials and with the same effort as more specific creations."

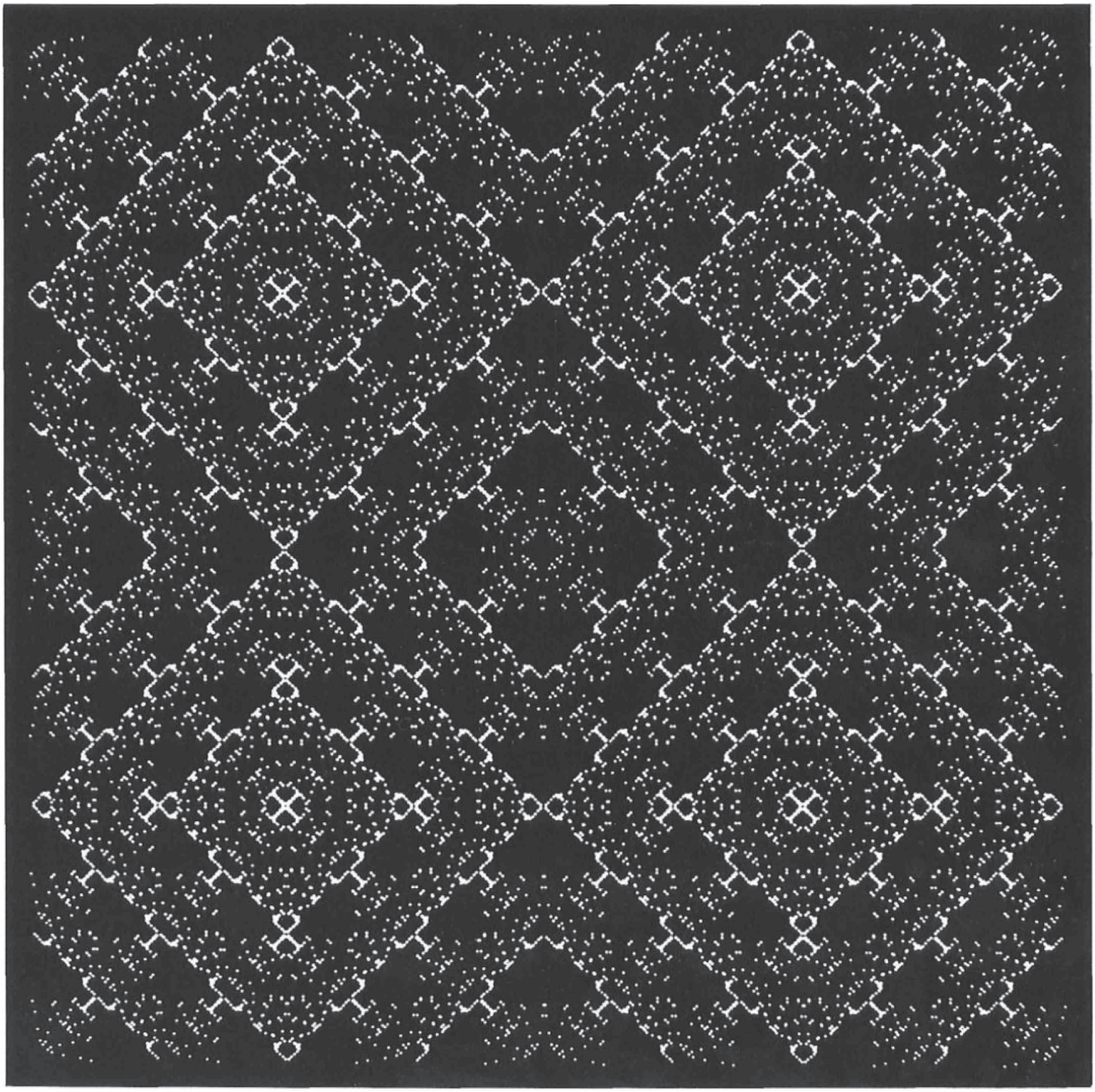
Kay's statement implies that the personal computer is a counterforce to rampant specialization. His "materials" are programs that run on computers to specify behavior which makes a specific creation (e.g. an animated film) or to specify a tool to make filmmaking easier, such as a translation program that allows the film programmer to use a "higher" level grammar.

Computer science and animated film/video making are two specialized fields which are producing hybrid offspring. The creative work of computer scientists and engineers is directed toward building tools, such as graphic languages, rather than producing entities, like animated films, which would be the artist's main concern. But the design of any high-level language is a trade of formal (theoretical) power for real (useable) power. No single language design can anticipate the needs of every artist. Just as the rank of part-time animated film/video makers has

swelled by the conversion of many full-time computer people, more computer artists will become involved in the design of the computer languages which define their universe.

That's why simulation-oriented languages which allow the user to design his or her own syntax and data structures as in Alan Kay's SMALL TALK, will become increasingly more important to the animation artist. In the past, film artists have been tool builders, specifically of animation machines, from Oskar Fischinger's wax block slicing machine (c. 1920) to John Whitney's analog computer-controlled animation stand (c. 1955), but now as Kay suggests, the personal computer transforms the tool-building activity into a symbol-manipulation activity.

A formal language, or more simply, a translation program, can be viewed as a game for which the rules are not permissive. The outcome of the game (the translated version) is completely determined by the source program and the rules. This determinism is desired of tools. But games that hold any interest for us have permissive rules. Programs can be written that produce animation but have players and rules like games. In music we have a long history of experience with an abstract temporal art form, and consequently many esthetic directions of computer animation have been anticipated by composers. The computer represents a new ability to manipulate in the visual sphere,



"p4mm series: cm'

parameters comparable to those which determine music (frequency, volume, timbre, rhythm, etc.) which musicians have dealt with freely for hundreds of years. "In C," the composition by Terry Riley, is a game. Riley has written a score which determines what notes are to be played and general order for playing them, but many parameters (like how many times a measure is to be repeated before moving to the next) are left to the discretion of the individual players of his music/game. Each performance is the same, yet different. That is, there are aspects which are fixed and aspects which are variable—degrees of constraint and variation which constitute a framework within which an instance is determined, in this case at performance time. This approach to music composition has been labeled "indeterminant" but no composition (if it's composed at all) is completely indeterminate. The composer chooses at a higher level the nature of the composition/performance game. (It is interesting to note that what Lilly calls a "simulation" in *Simulations of God,* Robert DeRopp called a "game" in *The Master Game.)*

The whole range of indeterminism lies within the boundaries of the game concept. Interactive computer animation extends this game designing and playing into the visual domain and can involve the viewer/audience as game player. A film although it may produce the illusion of motion, is a static form—a fixed entity which is passive to passive viewers. The potential of the computer is in bringing animation to life; it enables the animation artist to create an active art form which is experienced actively. Unlike "In C," which is played only by the performers, computer aural and visual experience games can be played by the audience/viewer/participant; the "specific creations" are the results of people experiencing a particular simulation in a world for which the artist/composer has written the rules of the game.

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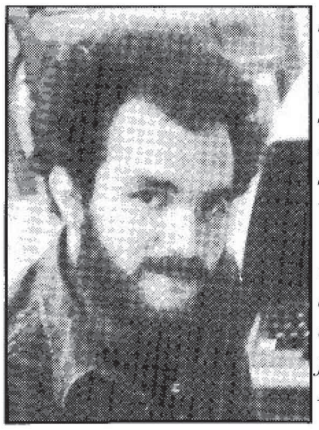

Since receiving his M.F.A. from CALARTS in 1974, Larry Cuba has used computer animation to study the relationship of linguistic and mathematical structures to graphic images and visual perceptions in three films: "First Fig" (1974), "Two Space (1979) and "3/78" (1978). In addition he has produced computer animation for the films "Star Wars" by George Lucas, "Arabesque" by John Whitney, Sr., and for various TV commercials by Bob Abel & Associates.