# The Computer: Liberator or Jailer of the Creative Spirit

*John Pearson*

ABSTRACT

This presentation covers some of the historical and aesthetic questions raised by the fine arts community regarding the use of computers by artists. Before addressing issues related specifically to the computer, the author gives a preamble that provides a context and creates a texture for the comments relating to the computer and its role in the visual arts. Comments are offered on the role of technology, science, mathematics, the humanities and aesthetics in the visual arts.

## PREAMBLE

It is fair to posit that technology is being looked to as the solution to all of our problems: medical, agricultural, political, educational. It is viewed as the new 'Savior', as our salvation. Unfortunately technology becomes self-perpetuating, building upon itself, becoming an indispensable factor in every facet of daily life, controlling the quality and mode of life to a frightening degree while offering increased liberty and the illusion of greater independence. Computers have become the new backbone of this technological syndrome and thus it is not surprising that certain artists are beginning to investigate them, assess their impact on the visual arts and either adapt—capitulate—to their magnetic powers or assimilate/appropriate their power and make it serve the purposes and needs of the visual arts.

## THE HISTORICAL ROLE OF TECHNOLOGY IN THE VISUAL ARTS

Technology has always been the handmaiden of the visual arts because, as is obvious, a technical means is always necessary for the visual communication of ideas, of expression, or the development of works of art—tools and materials are required. Without tools and some understanding of the basic physical and chemical properties of certain materials, sculpture and painting could not have developed. Without this development not only would societies not have progressed but neither would the arts. Casting made for more effective weapons for hunting and protection but also provided tools for the making of objects that fulfilled practical, aesthetic, intellectual or spiritual needs. While bodily demands were being met, a need existed to satisfy spiritual and intellectual requirements. Thus, a fabric of understanding regarding the realities of the environment became woven, the strands of this fabric being spun from relationships based upon fantasy tempered by personal experience and the observation of natural events. By the nineteenth century, carving, casting, painting, printmaking, weaving and pottery had become quite sophisticated as the mechanical and chemical technologies involved in these processes had developed. Since the middle of the nineteenth century, welding, photography, film, resins and plastics, and electronics media have provided artists with alternative approaches that have profoundly affected the visual arts. Now the computer has entered the scene and has been appropriated by artists because it offers exciting new means for expressing their ideas. All of the above technologies, except perhaps photography, however, were not developed by the artistic community for artistic purposes but by science and industry to serve the pragmatic or utilitarian needs of society. With the introduction of the assembly line facilitating mass production, the development of mass communication and advertising, and the development of mass distribution via air, rail and road, there has grown up a new society of consumerism that apparently has an insatiable appetite of global proportions. The technologies necessary for satisfying this appetite, and the attitudes it has sired, all are fair game for artists to use as they see fit. Computers are simply another one of these appropriations/utilizations.

## THE ROLE OF SCIENCE AND MATHEMATICS IN THE VISUAL ARTS

### Science

A major function of the visual arts, as of other disciplines, is to try to formulate an understanding of the nature of truth and reality. At different periods in history, for a variety of reasons—practical/material, political, etc.—certain disciplines have appeared more attractive or have been more successful than others at articulating these formulations and understandings. Philosophy, psychology, physics, mathematics and engineering have all been placed in the driver's seat and their ideologies have permeated all aspects of society including the visual arts. In great cultures of the past there was little separation between the humanities and the sciences. Art, mathematics, philosophy and science seemed integrated, exchanged ideas, learned from each another much more than today; but perhaps this is changing again as Eastern thought and quantum mechanics each increasingly echo the thinking of the other. However, since the rise of industrialization, the arts and sciences have regarded each other with suspicion and misunderstanding, and a

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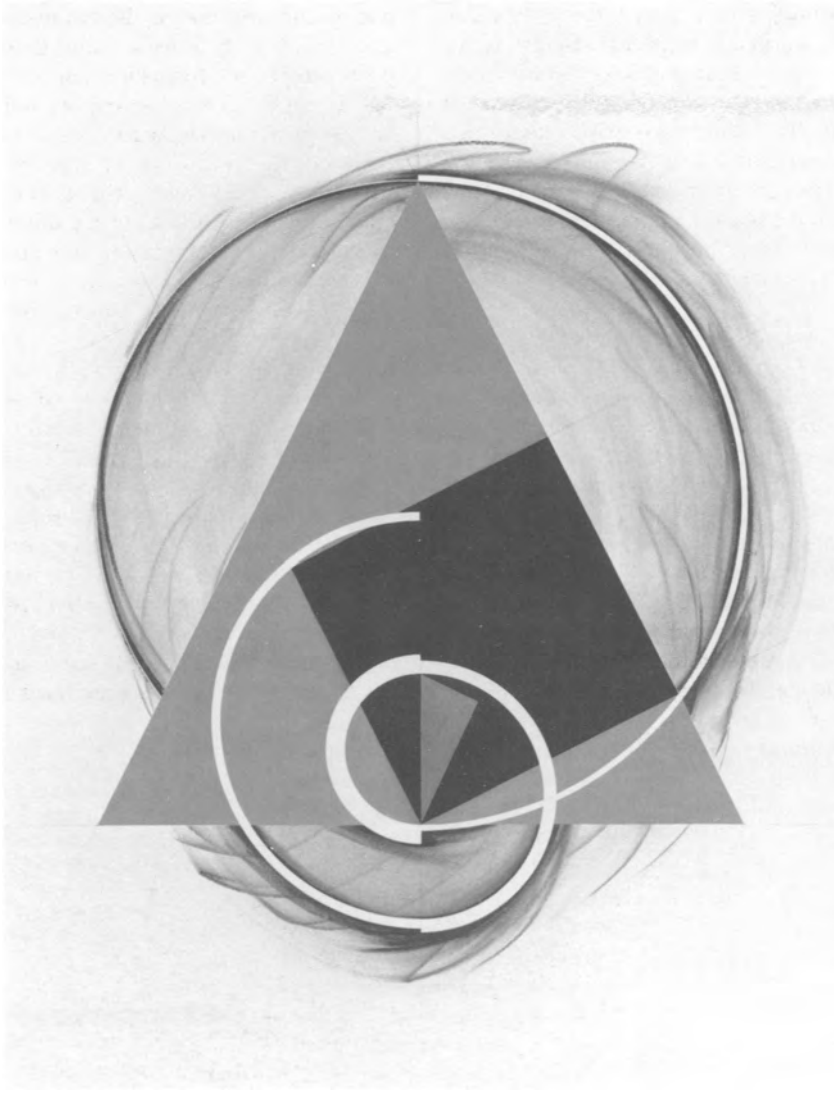


**Fig. 1.** ***Arc/Area/Section: Spiral-Flip 'A'*****, conte, charcoal and pencil on paper, 38 in × 50 in, 1983. (Photo © 1983 Brenda L. Lewison)**

chasm has come to exist between the two, which is not only unfortunate but also quite counterproductive.

Relativity theory also had its indirect influence on art, giving rise to Cubism. Heisenberg's notions not only heralded new attitudes in physics but influenced the visual arts, leading to the idea of the 'open system' in the artistic process and to the exploitation of randomness in certain forms of Surrealism and the Abstract Expressionism of Pollock. In this century, electronic engineering and chemical engineering (resins, polyesters, fiberglass, etc.) have had a profound influence on the images that artists create to express their ideas.

Today the most powerful modes of visual or audio communication are electronic, and the instantaneous transmission of images from one part of the globe to another has caused reality to wear a different mask. These communication modes are heavily invested in new electronic media and tools such as film, videocassette, television transmission and lasers; the computer is pivotal to the operation and performance of most of these electronic processes. Perhaps because this technology has entered the mainstream of life via its application through electronic entertainments, video recorders, video games, MTV and the home computer, the chasm is being reduced and the rift between art and science eliminated.

## Mathematics

Throughout history artists have consistently attempted to discover mathematical truths underlying the visual harmony and beauty of the ideal, from the architects, ceramists and sculptors of classical Greece, to Renaissance painters such as Leonardo da Vinci, Piero della Francesca and Cimabue, to twentieth-century figures such as Seurat and Le Corbusier. Perspective is a mathematical method of conveying the illusion of the third dimension—a mathematical construct describing optical distortion in time and space. Perspective was developed by the Renaissance architect Alberti, facilitating the next few hundred years of artistic involvement with creating works of art that echoed the optically perceived world as reality, the *eye* taking over from the *mind*. Conversely, because of the religious ban on images in Islamic culture, highly complex patterns were developed using simple geometric concepts as a point of departure. The obsessive nature of these patterns, covering the walls, floors and domes of Islamic mosques, produces a visually rich and intense aesthetic experience. Repetition and modularity as means of artistic expression have been used in other contexts, such as in the works of American quilt makers, the paintings of Andy Warhol and the highly retinal perceptual abstractions of Bridget Riley. Geometry has consistently appeared in the visual arts, whether as a means of generating regular patterns on fabrics or tiled walls or as a way of echoing the order and harmony, observed or intuited, in nature. The Greeks and the Egyptians used the Golden Mean of 1.618 in their architecture; during the Renaissance it was reintroduced as a design element, and it continued to be used by such seventeenth-century classicists as Poussin. Such applications have not been confined to the visual arts but have appeared also in music, an example being Schönberg's work. Today, Mandelbrot's fractals offer possibilities for the visual arts through the linking of fractal geometry to computer science, particularly image generation, manipulation and animation.

In short, artists have always been aware of not only the spiritual and intellectual climate of their times but also the technological, scientific and mathematical climate. They have either embraced it, absorbed it by osmosis and thus reflected it in their work or process, or added to the intellectual and technological development of their times, their symbiotic relationship to their times being inevitable. Today's artists have to face the computer if they are to be a part of these times and make a meaningful contribution.

## Is There a Relationship Between Art and Aesthetics?

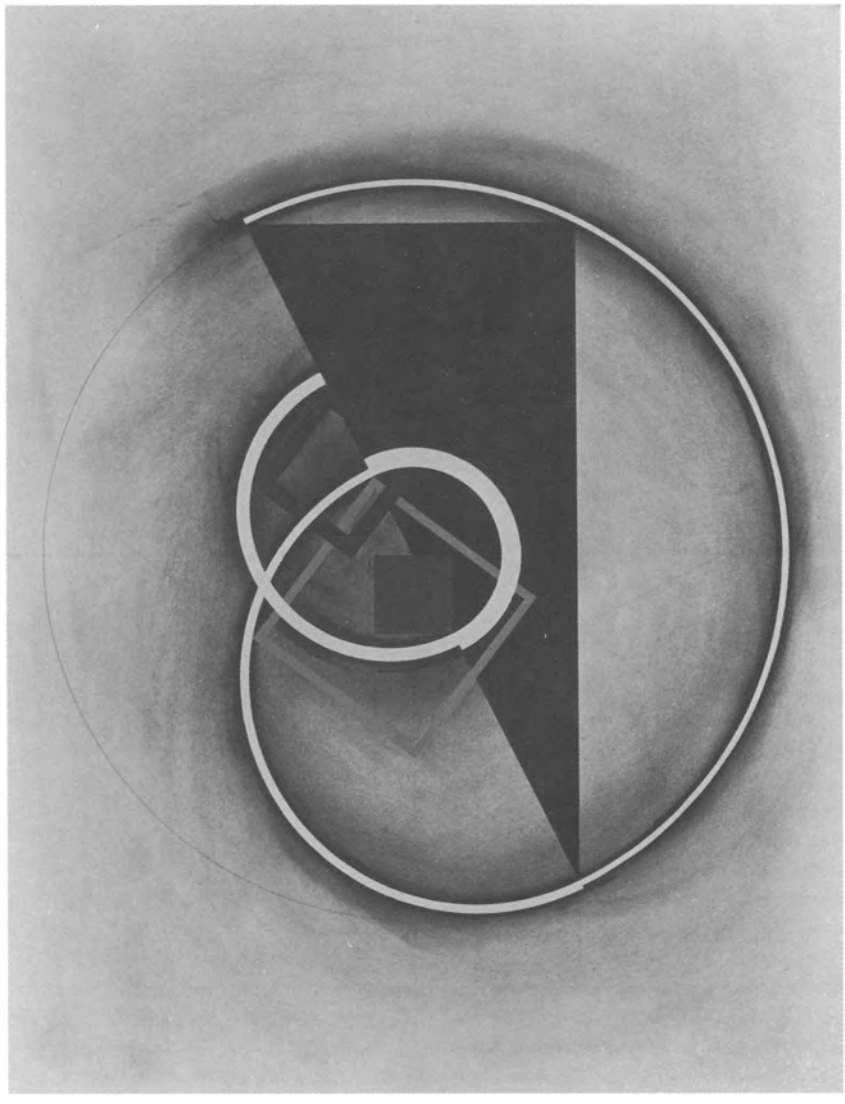
The linguistic root of the word 'aesthetics' can be traced to ancient Greece, where its meaning dealt with perception: "things (material as opposed to thinkable) perceptible to the senses". In the 1750s the German philosopher Baumgartner extended and distorted this strict meaning so it served that branch (science) of philosophy that dealt with the criticism of taste. While this extension was protested by many, most notably Kant, by the 1850s it was in common use, and the term was generally accepted as pertaining to the philosophy of taste, the theory of the fine arts, or the science of beauty. Today it is often posited that aesthetics basically translates as taste. But what is taste? Is it acquired? And if so how is it acquired?

At a recent lecture a young Chinese scholar, Hang Wu, related an incident that clearly illustrated taste to be based on cultural conditioning. He explained that in 1979 he curated an exhibition of both Western and Eastern portrait paintings and supervised its tour of villages throughout China. When villagers were asked which of the portraits were most objective—that is, most realistically rendered—without exception they selected the Chinese portrait paintings. When pressed for reasons as to their selection they replied that "there are no smudges of brown, or other colors, on the faces of real people". Such 'smudges' they found only in the Western portraits. It appeared that although the portraits of the Chinese personages in the Chinese paintings were all quite similar and could bear little, if any, physical resemblance to the particular facial characteristics of the sitters, they were viewed as being more objectively realistic. The scholar who arranged the exhibition had been trained in painting and also was a Western-style painter who had lived in the U.S. for 16 years. He was used to (had been conditioned to understand) the rules of Western painting and thus was surprised at the above responses.

This story aptly demonstrates that the visual interpretation (translation) of images is based on cultural conditioning. It is also possible that we unwittingly learn, i.e. are taught, to think in particular ways that condition our communication of information via visual means. When children are asked to draw a landscape to include the sky, grass and flowers, they work in an abstract manner. They will draw green on the bottom of their paper and may even have flowers growing out of the bottom edge of the paper. The sky more often than not will be a blue band at the top of the page. If asked why they have left a large empty space in between the sky and ground they will make statements that in effect say that that is the way the real world is—there is only space between the ground and sky. In short they are depicting what they *know* to be true as a complete realistic physical experience and not depicting only an accurately observed *optical* experience. It would appear, then, that the mind understands experience holistically, engaging and synthesizing the subtle nuances of all of the senses, rather than perceiving only information transmitted through (seen or sensed by) our visual organ, the eye. Artists—visual as opposed to audio—try to discover methods for translating the experiences of all of the senses into a singular, purely visual language. This language is constructed from numerous experiences—personal, local, regional, national, international, physical, psychological, cultural, sociological, political, racial, religious, etc.—which have been filtered, consciously and unconsciously, through emotional and intellectual fabrics, again both personal and cultural. I believe that it is this same process that determines both personal and cultural taste. Thus patterns are established that determine aesthetic judgment.

It is generally accepted that Darwin's theory of evolution—the theory

**Fig. 2.** ***Arc/Area/Section: Double Flip*****, conte, charcoal and pencil on paper, 38 in × 50 in, 1983.**



of natural selection, the notion of the survival of the fittest—is the best explanation to date of how the human species developed. Perhaps an analogy could be made whereby Darwin's 'model' could be applied to aesthetics. The story of the Chinese portrait exhibition reminds us strongly of the cultural differences between East and West. The history of the cultural evolution of both is not a topic we can cover here but it is fair to say that each has quite different and yet highly developed cultural traditions. These traditions color intellectual and emotional assessments of all circumstances. Breaks with these traditions—digression, whether growth or regression—are viewed with suspicion, often fear.

The word 'connoisseur' usually means a person well acquainted with one of the fine arts, a critical judge of art or matters of taste (wines, delicacies, etc.). A connoisseur of art acquires judgement or taste by continued dedicated interest in, and study of, art within a given set of parameters—the parameters of extant objects enveloped within understood traditional cultural values. These may be political, moral (Michelangelo was attacked for the nudity of his figures in the Sistine Chapel), philosophical, religious or aesthetic. Fashion is a perfect example of the latter: hemlines up/hemlines down, tight pants/baggy pants, long hair/short hair, etc. Because we are closest to contemporary art there is a tendency to think of it as the most controversial, but all advanced art of the past has suffered from contemporary criticism and quite often outright rejection, many if not all new ideas would appear to suffer this fate. However, it is via persistence and consistent qualification that new attitudes ultimately become accepted and synthesized into the culture's mainstream of life and thought.

New concepts that bring new images and new materials are usually in conflict with the accepted aesthetic of the status quo precisely because there are few if any criteria against which they can be measured. They do not fit the standard aesthetic yardstick. Thus they are perceived as a threat to established traditions, and here lies the crux of the matter. Art deals with ideas, concepts. Aesthetics deals with taste, and it is aesthetics that causes rejection. A New York art dealer once indicated to this writer that art must be a threat—it must be confrontational to either ideas or taste. And recently someone said, "If it looks like Art, it probably isn't." Thus we have a conflict between art and aesthetics, and the relationship between art and aesthetics is at best tenuous. To quote Barnett Newman, "Aesthetics is for artists like ornithology is for birds".

Computer imaging is only 25 years old. It has no tradition. Not enough time has elapsed for the cultural conditioning necessary either for this new process to be added to our aesthetic storeroom or for it to become modulated to fit current critical/evaluative criteria. So who is to say that the images we are now being bombarded with—the endless logos we are 'flown' through on TV commercials, the glitzy still lifes, the lifeless landscapes, the mechanical figures—are not art or do not already have their own aesthetic?

## Is There a Computer Imaging Aesthetic?

Given that there are strong similarities in the appearance of images produced whenever the computer has been involved in the generative process, given that it seems most difficult to shun the label 'computer art', and given that the art establishment continues to reject these 'computer' images, it would appear that the answer to the above question must be 'yes'. What is it, then, that identifies and differentiates these images? The answer is simple yet complex.

The simple answer might be that there is still a serious but narrowly focused fascination on the part of the artist, artist-engineer and artist-computer scientist, as well as the public, with the technical process, with the 'magic' of this machine. Few seem to be able to go beyond or transcend this hypnotic fascination. The public still attaches too much significance to the *power* of the computer. This leads to the myth (or is it a myth?) that because the computer *assists* in solving problems, in reducing tedious labor, in executing a work, it has the power, the capacity, to *generate* or create self-generated works. How often have we heard "that was done by computer", as if this validates a work's existence? Technically it may be interesting, even most impressive, but from a conceptual, intellectual or artistic point of view the work does not withstand analysis. Only the creative imagination of the artist, cultivated from a solid conceptual base and tempered by a sophisticated visual sensitivity, can develop and resolve the problems of art.

With traditional art media there is a much more direct involvement of the artist with the medium—a tactile and scale involvement—where there is direct feedback from at least two sensory organs: the eye and the hand. The sense of touch is very important to artists, and it is finely tuned. The painter, for instance, must build from scratch and add everything. He/she therefore learns to develop a direct response to his/her eye-hand-intellect-emotions, a direct link between seeing, thinking and feeling. The photographer does not have this luxury, however. When he/she establishes an image (I use the term establish on purpose because the photographer learns how to organize and control via light and editing) he/she takes a chaotic world and organizes it with his/her trained eye. In one sense the photographer edits out information from the plethora of images presented, creating a focus so that the image serves his/her intentions.

The artist, no matter what medium he/she chooses, is a decision maker. If he/she uses a computer, it is as a tool or, as I like to think of it, an assistant, a conduit, a means of transmitting/expressing ideas visually. Questions must be raised, therefore, regarding the quality of the ideas and the quality of the decisions being made when images are produced by electronic means. If the ideas simply revolve around demonstrating the technical virtuosity or prowess of the machine or programmer, then the artist-technician has simply become an extension of the machine, in a sense its slave. In this case, only technology is served, for the work is a closed system involved only with technology. The machine should be an extension of humanity, of human senses, ideas and vision, not the other way around. Technology, in and of itself, is not art. Technology for technology's sake is as redundant and meaningless as the idea of art for art's sake. Art or technology should be for the people's sake, society's sake; it should serve some purpose—intellectual, spiritual or even functional. Even paintings by Morris Louis, Kenneth Noland, Jules Olitski and Helen Frankenthaler or the Lyrical Abstractionists of the late 1960s (Showel, Poons, Walker, Seery, Snyder and Christianson), works that appear to be

only about paint or color, served not only as individual expressions but more importantly as metaphors of the heroic, the poetic, reflections of the inner self of the artist, representations of the unseen but deeply felt inner human reality.

At this juncture it is probably important to be reminded that the development of imaging systems was by and for industry and covered a wide range of industrial applications: graphic design, medicine, film, TV, etc. It was not developed with the fine arts in mind. Thus software development was specifically directed at these pragmatic-minded, 'client-oriented' industries. The software determined that the images produced, being 'client-oriented', would have clarity and little ambiguity and would be clean, crisp, efficient and practical. As in early photography, detailed accuracy was equated with factual truth.

The whole gamut of historical developments in art, from perspective to realism, has been re-invented by computer scientists (technicians) re-enacting the same painfully slow visual evolution and patterns of growth experienced by the artists who first dealt with these problems. Why do images created by ray tracing seem accurate but mechanical and unreal, far from natural or realistic? Why is it that computer-generated landscapes are recreated (represented) almost diagrammatically, as 'sky is blue, grass is green, trees are brown'? The Impressionists and color photography taught us that 'local color' has no absolute value because all color is activated, and modulated, by the ever-changing conditions and circumstances of light. Further, the aim of art is not to recreate visual (retinal) objective reality only. Realistically rendered images serve as only one part of the artist's expressive vocabulary, and quite often deviation from optical reality becomes a must in order that a painting echo the artist's intentions or create a more cohesive resolution that is both expressive and has visual plasticity. In computer-generated imagery, local color becomes an absolute. In painting it is the modulation of color that gives the painting its plastic unity. In computer-generated imagery, adherence to local color via ray tracing and stiff paint systems results in a lack of plastic unity—the separate objects remain as separate objects and are not convincingly unified in any plastic way.

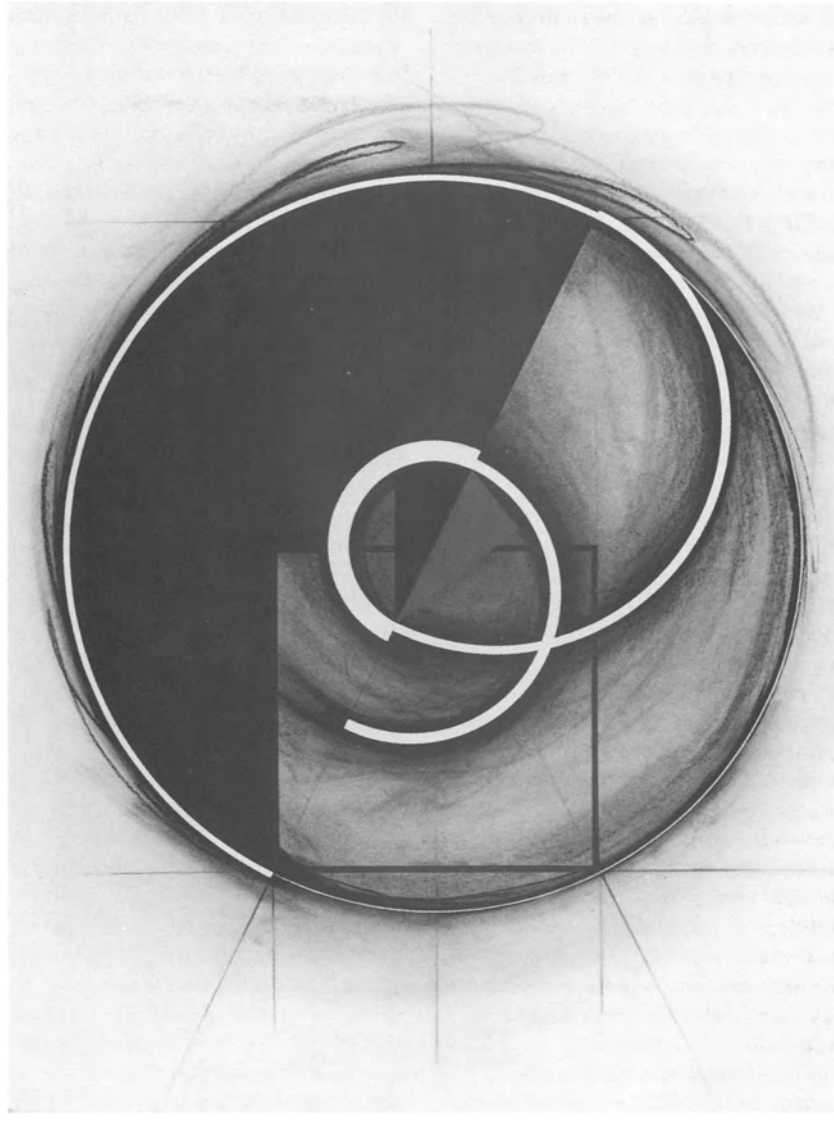


**Fig. 3.** ***Reassess #2*****, conte, charcoal and pencil on paper, 38 in × 50 in, 1984.**

Donald P. Greenberg in an article in the February 1988 issue of *Communications of the ACM* makes all of this clear. In his superb article he indicates that strides are being made to rectify this problem by focusing upon color 'interactivity'. Referring to it as 'the hermicube radiosity approach', he cites the research being carried out at Cornell University that attempts to come to terms with this color plasticity problem. Another stylistic manifestation of many computer-generated images is that when they are formula-written they tend to have a rather simplistic, predictable, patterned structure—predictable in the sense that the final resultant images within their structure have no visual surprises.

Tom Linehan pointed out in a talk at SIGGRAPH '85 that with computer imagery the artist begins with a three-dimensional void. Within this void pure fantasy can be created and very effective special effects generated via animation. Animated TV logos are extremely effective, and while one might become a little tired of flying in and out of letters of the alphabet, they are eye-catching, visually engaging for the moment and therefore most effective for the 'client'. They are carriers of specific but limited information; there are no metaphors. They are in effect mindless. Each time we view them we gain no new information, no new insight: in short we are not educated or experientially revitalized. We contribute nothing, our involvement is passive. Computers are most adept at producing this type of image, and it is the type archetypically associated with the computer. It is hard for artists to shake the perception that computers can only, or must always, create such images.

Conceptual art of the 1960s explored and challenged the linguistic

base of art; much recent painting has concerned itself with social issues, angst, politics, etc. Neither deals with technical issues, and in fact such issues are not considered relevant to the art idea. Thus in conceptual art we see a totally desensitized, nontactile, colorless set of objects—most often with no image attached, as in the work of Lawrence Weiner. At the other extreme, in recent painting we see surfaces exploding with tactile, gestural, densely colored images full of metaphoric or literal information. Yet the technical means are only the means to an end; the technical facilitates the bridge to the conceptual roots of the work, the poetic, spiritual essence of the work. As outlined above, in computer-generated images the technical often seems to be a closed loop, a pipeline back to the technical. There is a great temptation on the part of artists who use computers to try to retain the imprint of the computer's involvement and thus to inform us that their images are arrived at through sophisticated electronic means. In other words they are reluctant to let the image or idea stand by itself. The question we must now pose is, Is this any different from painting? If so, how?

Painters in the last half of the twentieth century, from Jackson Pollock to Chuck Close, from Brice Marden and even Robert Mangold to Sigmar Polke or David Salle, are concerned with the appearance of the paint—the revelation of the process of painting. If the quality of the paint plays an important role in how we assess the worth of a painting, should the qualities produced by images developed electronically be treated differently? The answer of course is that they should not. The surface qualities of any medium should support, indeed be integrated into, the holistic concept of the work. They should not be the only thing that our mind focuses upon. Unfortunately, with electronically developed images this is perhaps what happens all too often.

Electronic tools are still resistant and clumsy and do not facilitate working in a direct and expressive manner. The software has been written to eliminate unevenness of line or any other accidental marks. It could be posited that charcoal is also a clumsy tool. Drawing with charcoal, as we see so beautifully in Matisse, involves a great deal of trial and error, a great deal of learning, of programming. Charcoal is both clumsy and primitive as a tool but in the hands of the right person, with training and sensitivity as well as imagination, it becomes a conduit, a means, by which sensitively rendered images expressive of the artists intentions and emotional state can be produced with tremendous effectiveness. When an artist uses a material or tool long enough, when the artist is thoroughly familiar with a tool, it becomes, in a sense, an extension of the self, instinctive and thus invisible. Currently this directness is not available with computers.

Computer imaging today could be compared to the disciplines of printmaking and photography, which are also technical processes involving intermediaries. In fact, the best prints today seem to be produced for artists by print workshops. This collaborative approach might well be productive for artists in terms of computer imaging. Both photography and printmaking (especially silkscreen) offer extremely efficient methods of creating a multitude of variables of an image quite rapidly. The changes or choices and decisions regarding the images produced by these processes are arrived at by direct, hands-on, tactile involvement where 'accidents' occur, the unexpected happens and the eye and mind build on these accidents by acceptance or rejection. This leads to my final point. It would appear that, because there is little or no evidence of the hand in computer-generated imagery, such imagery is dismissed as not being art.

This argument has consistently been leveled against photography. Photography had to learn to transcend its fascination with its technical capabilities, which limited conceptual evolution. Photographers, as well as the general public, were enthralled by the capability of their medium to capture every minute detail of any subject, albeit in black and white, in their photographs. In fact it was thought to be irresponsible to manipulate images, the implication being that the artist thus would be manipulating the truth. Today we know differently, and photographs are manipulated by the artist in a multitude of ways at the service of his/her vision. However, the fact remains that initially artists and photographers were impressed by the technical attributes of their medium and only later were able to transcend this limiting fascination with technology. In a parallel way, computer imaging has to overcome its fascination with its own technology; it must stop looking solely inward at its own capabilities and begin asking serious questions about its purpose beyond its commercial applications. It must address issues and ideas concerning the nature of art and the purposes of art.

## WHAT DO WE MEAN BY 'COMPUTER ART'?

A major problem with the label 'computer art' is that it is linguistically and semantically incorrect. We do not say 'sculpture art' or 'painting art'. What then should we call images created with a computer? Perhaps they should be called computer or digital images, and the process, computer or digital imaging, and if these electronic images are successful in communicating artistic intentions they should then be called art.

Computers are machines that are engineered to be extremely precise and incapable of making mistakes and to follow only the strict logic of their circuitry and of the instructions of their software written to utilize this circuitry. But as Sol LeWitt said, "Artists jump to conclusions that logic cannot reach"[1]. Thus, if one accepts LeWitt's statement, computers cannot be artists, they cannot alone make art. This may lead to the assumption that there can be no such thing as computer art.

LeWitt's point is well taken, and I have chosen it to stress that the *computer* does not make art. However, in the hands of the artist it can become a tool, perhaps also the material, to serve the creative ambitions of the artist. Tools and materials, whether welded or cast metal, photograph, charcoal on paper, or paint on canvas, radically affect the resultant appearance and therefore the projected meaning of a work of art. Each of these materials has a history, a tradition, which also colors or affects the appreciation and understanding of a work of art. When we look at a Rembrandt portrait, for instance, we understand it on many levels at once: we perceive the subject because of the particular history of the sitter; but we can also perceive the formal construction of the painting, the use of light and shade and texture and how the artist has manipulated the paint itself. We finally comprehend and appreciate it holistically as a painting, understanding that the paint has been

modulated to communicate the complete, as opposed to simply the literal, meaning of the artist's intentions. We appreciate it in this manner in large part because painting has a tradition, and the history of that tradition cannot be obliterated or denied when we see paintings. Our aesthetic, our taste, is tempered by this tradition.

The historical tradition of computer imaging spans a mere 20 years, but as outlined above, computer imaging seems to have certain stylistic tendencies. These stylistic tendencies have been determined by factors outside of art, and they strongly affect the appearance and therefore the understanding of the images created. Yet at this point computer images mostly seem to mimic art executed with traditional art materials. Artists who use computers seem to retain their own personal history of materials. Thus they fight the computer's potential by trying to force this historical will upon it.

Computers can be employed, like any tool, to make art. Computers by themselves do not make art. Perhaps the software that makes possible the attributes that then become available to the artist is where the art of computers resides.

## Advantages and Disadvantages of the Computer for the Artist

### Advantages

1) That the PC and software development have made the computer accessible is a given.

2) The computer offers the artist the possibility of testing a range of ideas very rapidly within a given set of parameters.

3) Images can be generated by paint systems, digitizing or formulas or by any combination of these.

4) Images can be stored and retrieved almost instantaneously. This allows for the storing of an image when it is at a successful stage yet allows for further development of that same image. If a series of erroneous decisions is made during this further development, the initial, successful image can be recalled and nothing has been lost physically. In fact, taking risks need not be a disaster; this results in expanded, new learning experiences.

5) In formula-written images an artist can see a tremendous range of possible configurations developed within the strict parameters of his/her concept. Thus the artist can develop a much larger database than by traditional means.

6) Images can be easily transported using optical disc, floppy disc or tape.

7) The structure of an image, its color, shape, size, location, density, etc., can be manipulated in real time and much faster than by traditional physical means.

### Disadvantages

1) The artist can become obsessed with the technology, be seduced or hypnotized by it, and simply become an extension of the technology.

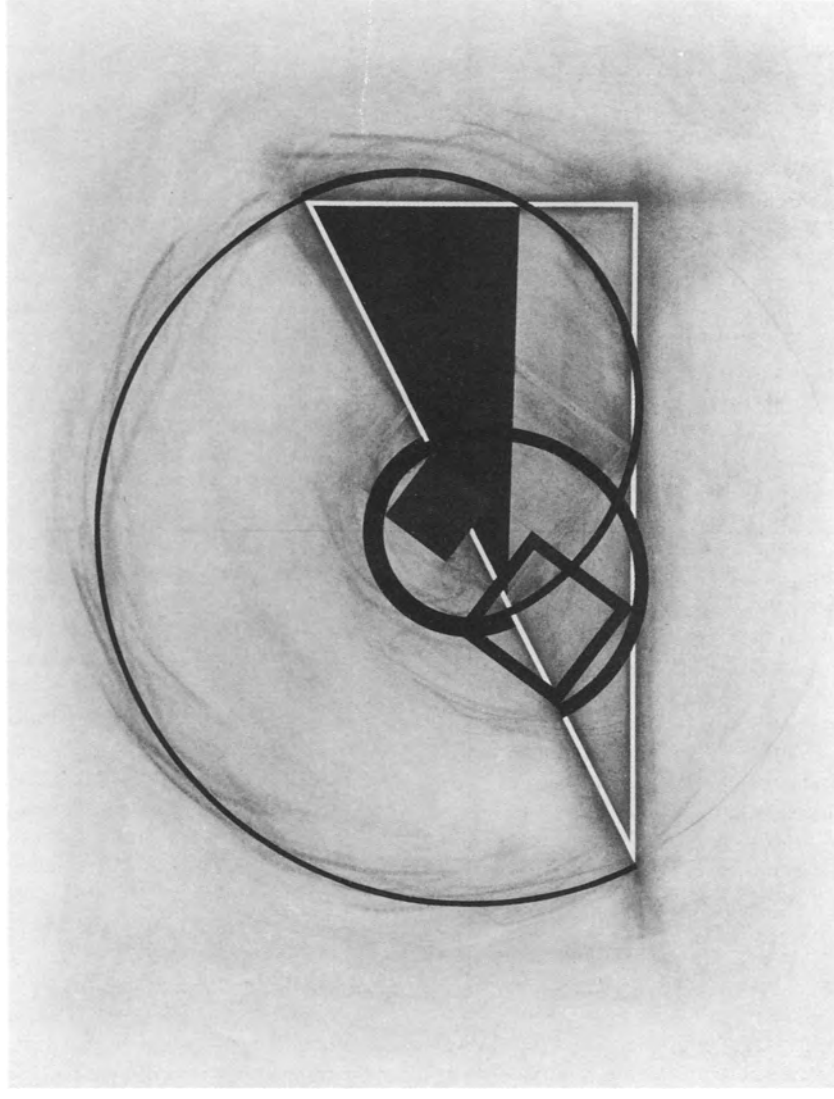
2) Unless the artist is somewhat sure of the conceptual terrain to be explored, the information overload could be overwhelming. It is also possible that, if the artist is not sure of the purpose of using the computer, the technology will again seduce, and the artist will be taken over by the technology.

3) A major problem of the computer is scale. The artist is limited to the size of the monitor and the ideas quite often suggest much grander scale. Thus, scale is virtually lost on the computer.

4) The artist can have no experience of surface, no real tactile involvement with the work.

5) The uniformity of the system's attributes is overpowering: a line cannot be emphasized or inflected in a direct, emoted manner. While one feels the different tensions in one's hand and arm and in one's emotional makeup, the line on the monitor screen remains totally unmodulated. Software

**Fig. 4.** ***Sectional Open Spiral—Flipback*****, conte, charcoal and pencil on paper, 38 in × 50 in, 1984.**



needs to be written or hardware developed to address this issue.

6) Finally and most importantly, the computer is capable of generating so much information within a narrow set of parameters that it would be quite easy to stay within that narrow set of parameters and thus stop any further intellectual/conceptual growth or development; ideas can ossify. In my own work, for example, I have generated over 14,000 individual linear drawings that I could use ad infinitum probably for the rest of my life without advancing one iota conceptually. I would simply be creating variation upon variation of a well-established and well-known structure. The poetry would surely exhaust itself.

In summation it is clear that the *computer* is neither liberator nor jailer of the creative spirit. The artist's attitudes are what will decide that issue. The manner in which the artist approaches this challenging and exciting technology will determine whether or not the creative spirit is limited or enhanced.

## My Own Work

Since 1973 I have developed a fickle 'love/hate' relationship with the computer, because it always has seemed to command too much of my time in learning its 'language' or its technical attributes and/or limitations. Currently I view the computer as an efficient tool in much the same way that I viewed power tools in the early 1960s. Not wishing to become a 'slave to the machine', and given my priorities, I have resisted the desire to learn programming, although I have some knowledge of Pascal. At the same time, however, I recognize that it is perhaps in the creative development of imaging software that the essence of art resides for the computer. I also do not wish to be a slave, introspectively limited, to my ideas, and the computer is most useful in this regard. It is an efficient tool that can clear out ideas expeditiously. Beyond that it has 'taught' me, challenged me, to be much more open and adventurous by revealing that even a simple idea can be multifaceted. At a purely intuitive and subjective level many of these facets would have been overlooked.

The computer generates a tremendous amount of visual information. This creates a dilemma, or perhaps a paradox: while the computer seems to save time, it generates far more information than can be absorbed, and thus it seems impossible to keep the information under control. The computer is a tool that differs in a major way from previous tools. It can present the artist with accurate alternatives to variations of the original image while remaining solidly embedded within the parameters of the main concept. However, while it works to generate new visual variations, it is confined to the set parameters and *cannot generate new ideas.*

### Technical Reference for My Own Works

It is ironic that, while technology offers to be an efficient servant, ultimately it seduces rather than serves the artist, who, like society, becomes a slave to the technology. It is important to escape this trap.

I have been using computers interactively by using the results achieved with the computer with other traditional artists' materials for many years. The following explains my process, although from a technical point of view only.

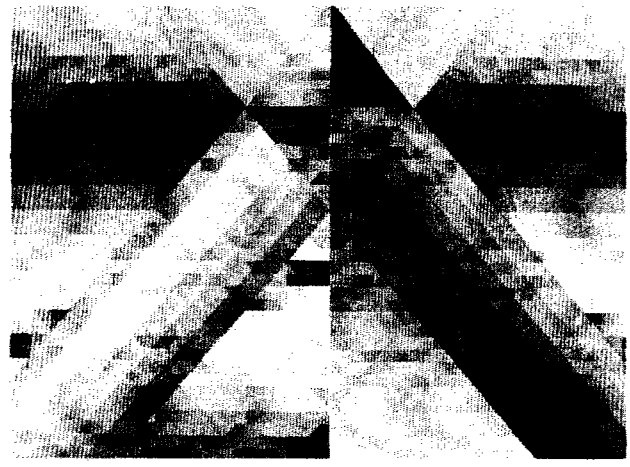
**Simple Image Generation and Plotting.** The software was written in Fortran by Ken Ghiron, rewritten in C by Mike Ashley. This software allows for the generation of all possible permutations of a set of simple geometric shapes which are related according to the Golden Mean. Each of these shapes is consistent in surface area (according to Fresnel). Images were first generated on a Tectronics 4013 terminal. Images were plotted on a CALCOMP Graphics Drum Plotter #563, each plot containing 256 unique linear images for a total of 11,880 images. The host computer for the CALCOMP Plotter was a Xerox Sigma 9. Pastel/pencil/charcoal drawings (38 in × 50 in) were then hand-executed from these plots whereby the original generative and underlying structure, plus minimal color and gesture, were added (see Figs 1–4).

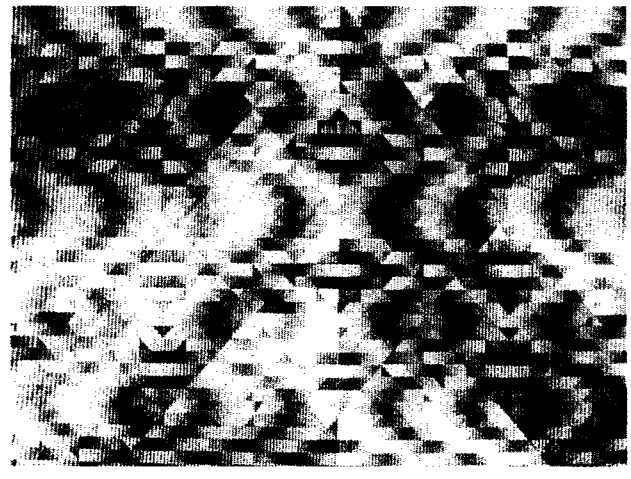
**Digitizing and Image Manipulation.** The above pastel drawings were digitized (using filters to achieve pseudocolor) into a COMTAL VISION 1–20 (3M) system with a 512 × 512, 8 bits monitor. Software was developed by Ed Angel, David Gold and John Brayer of the VAX Research Center of the University of New Mexico. The host computer for the COMTAL VISION 1–20 was a VAX 11/780 by Digital Equipment Corp. Digitized images were manipulated; the structures and color were altered. Emphasis was placed on color manipulation. Slides of the manipulated images were automatically recorded using a Matrix Instruments Image Recorder (Color Plate B No. 1, bottom). Pastel/pencil/charcoal drawings (38 in × 50 in) were then hand-executed using the slides of the digitized images as models or points of departure (Color Plate B No. 1, top).

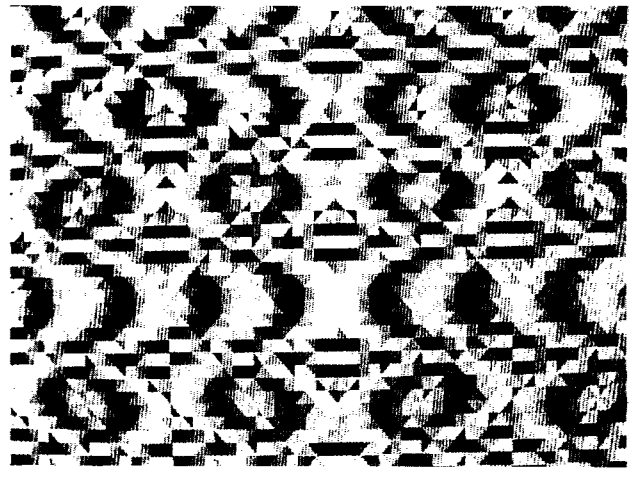
**Colored Plots.** These plots were executed on a Hewlett Packard plotter HP7475A using software developed in C by Mike Ashley for use on an AT&T PC6300 with a TARGA 16 board and 20-megabyte Hard Card coupled to a Sony CPD1201 color monitor. Large shaped and relief paintings were also created using these plots as points of departure.

### Reference

1. This famous dictum is quoted from Sol LeWitt's 25 statements on art, 1968.







**Color Plate B**

**No. 1. Left. John Pearson, (top) *Finale #3*, pastel and pencil on paper, 38 × 50 in, 1988; (bottom) *Fresnel Proposition: UNM Series #8*, electronic (digital) image and 35-mm slide, 1985.**

**No. 2. Right. Edward Zajec, (top to bottom) a thematic dissolve is shown. Two transparencies can be displayed concurrently on the screen and layered and unlayered at will. The thematic character of the dissolve comes to light when the action of the underlying transparency (the ray in this case) weaves itself into the upper transparency's action. Important here is the temporal nature of the dissolve, which involves structural changes that closely interrelate motive development with color modulation.**