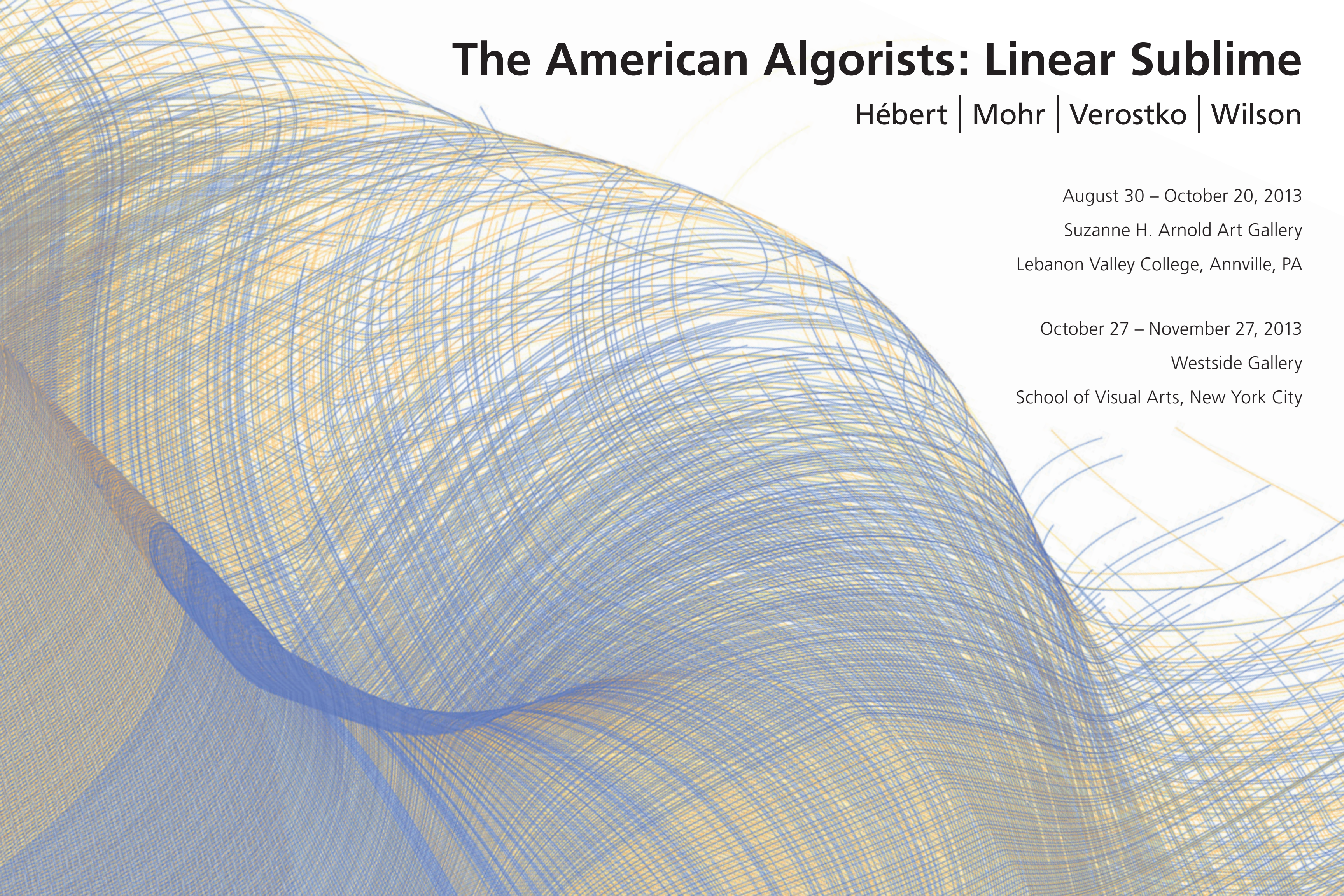

The American Algorists: Linear Sublime

Hébert | Mohr | Verostko | Wilson

August 30 – October 20, 2013

Suzanne H. Arnold Art Gallery

Lebanon Valley College, Annville, PA

October 27 – November 27, 2013

Westside Gallery

School of Visual Arts, New York City

The American Algorists: Linear Sublime

August 30 – October 20, 2013

Lenders to the Exhibition

Anne and Michael Spalter, the Anne and Michael Spalter Digital Art Collection, Jean-Pierre Hébert, Manfred Mohr, Roman Verostko, Mark Wilson

Sponsors

Support is provided by the Lebanon Valley College Colloquium, Anne and Michael Spalter, the New York Digital Salon, School of Visual Arts MFA Computer Art Department, Lebanon Valley College's Master of Science Education and the STEM program, Suzanne and Ronald Schrotberger, and contributing members of the Friends of the Gallery.

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On the cover

Detail, Jean-Pierre Hébert, *Pillar of Infinitude, Fragment,* 2011, inkjet pigments on Niyodo paper, 22 x 17 inches, artist's collection.

Artist Talk

Friday, August 30, Suzanne H. Arnold Art Gallery, 4 p.m.
Algorist artists Jean-Pierre Hébert and Mark Wilson.

Opening Reception

Friday, August 30, Suzanne H. Arnold Art Gallery, 5-7 p.m.
Hosted by Lebanon Valley College President Lewis Evitts Thayne and Dorry Thayne.

Lecture

Monday, September 9, Zimmerman Recital Hall, 5 p.m.
Algorist artist Roman Verostko.

Art Discussion/Colloquium

Wednesday, October 16, Zimmerman Recital Hall, 5 p.m.
Manfred Mohr, digital art pioneer, and Dr. Grant D. Taylor will discuss Mohr's groundbreaking use of the computer during the culturally volatile early 1970s in Paris, where he was attacked for employing computers to create his art. Talk will be held in conjunction with the College's annual Colloquium "Revolution."

Gallery Hours

Wednesday, 5 – 8 p.m.
Thursday – Friday, 1 – 4:30 p.m.
Saturday – Sunday, 11 a.m. – 5 p.m.
and by appointment for groups.

To arrange a private gallery talk for your school or organization, please contact the Gallery at gallery@lvc.edu or 717-867-6445.

Acknowledgements

The American Algorists: Linear Sublime (Aug. 30 – Oct. 20, 2013) came to fruition thanks to the collaboration and contributions of many individuals. First and foremost, our thanks go to Dr. Grant D. Taylor, Associate Professor of Art History at Lebanon Valley College for curating this innovative exhibition and bringing to light the works of the Algorists as an important chapter in the history of American art through his elegantly written essay. The Suzanne H. Arnold Art Gallery would like to extend sincere thanks to those who so generously loaned works to this exhibition: Anne and Michael Spalter, Jean-Pierre Hébert, Manfred Mohr, Roman Verostko, and Mark Wilson. A special word of appreciation is extended to Bruce Wands, director of the New York Digital Salon and Chair of the MFA Computer Art Department at the School of the Visual Arts for hosting this exhibition at the SVA Westside Gallery and for writing the foreword to the catalog. Grateful thanks are extended to G. Daniel Massad for editing and contributing to the text. Crista Detweiler's unflagging assistance in all aspects of the preparation of this exhibition is deeply appreciated. *The American Algorists: Linear Sublime* would not be possible without the sponsorship of the Lebanon Valley College Colloquium headed by Dr. Robert Valgenti, director of the College Colloquium. Special thanks are given to Anne and Michael Spalter, the New York Digital Salon, and Lebanon Valley College's Master of Science Education and the STEM program for their sponsorship of this exhibition. We are grateful for the support of President Lewis Thayne and his wife Dorry for their efforts to make this a memorable exhibition. For their continued support, we thank Suzanne and Ronald Schrotberger, the Gallery Advisory Council, the Friends of the Gallery and the many members who have generously supported this exhibition.

Barbara R. McNulty, Ph.D.
Director, Suzanne H. Arnold Art Gallery

Foreword

Bruce Wands
Director, New York Digital Salon
Chair, SVA MFA Computer Art Department

To celebrate the 20th anniversary of the New York Digital Salon, we have chosen the exhibition *The American Algorists: Linear Sublime,* which showcases the works of Jean-Pierre Hébert, Manfred Mohr, Roman Verostko, and Mark Wilson. Curated by Dr. Grant D. Taylor, Associate Professor of Art History at Lebanon Valley College, the exhibition begins its run at the Suzanne H. Arnold Art Gallery from August 30 to October 20, 2013. The exhibition will be on view at the Westside Gallery, School of Visual Arts in New York City from October 27 to November 27, 2013.

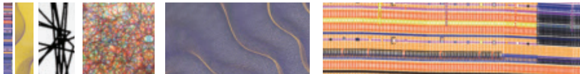
The creative histories of these artists go back decades. Roman Verostko and Mark Wilson exhibited their work in the First New York Digital Salon in 1993, and Manfred Mohr has appeared in several salons. I have followed their careers closely, and as the current Chair of the SIGGRAPH Art Awards Committee, I should note that Jean-Pierre Hébert was selected for the Distinguished Artist Award for Lifetime Achievement in Digital Art in 2012 and Manfred Mohr is the 2013 recipient. Roman Verostko received the award in 2009.

I first became involved in computer art in 1976 while a graduate student at Syracuse University. The only computing resource available was the university's IBM mainframe. Access was limited—we would drop off a stack of punch cards in the morning and retrieve a line drawing anywhere from a few hours later to the next day. However primitive this may seem by today's standards, it presented an epiphany regarding the future of contemporary art. Using the programming language ARTSPEAK, I saw that the computer could draw lines and shapes with far more precision than the human hand, and offered new conceptual territory rooted in mathematics. In these early years, there was considerable resistance from the established art community to recognize new media. Computer art could not be categorized within the traditional fine art standards of drawing, painting, and sculpture. The lack of archival printing methods and curators who understood digital creativity added to the struggle. In his 1985 book *Drawing with Computers*, Mark Wilson expressed, "In the past, computer art has elicited much interest. While the art world became enamored with technology in the late sixties, it soon lost interest … New realism and photorealism became dominant in the seventies and, in turn, were displaced by a rekindled interest in expressionism. Thus, the New York art world has largely ignored computer art." This statement comes close to encapsulating the history of digital art. The initial infatuation with computer art was seen simply as a trend. Since then, this has changed and contemporary art using new technologies is now viewed as just that—contemporary art. Emerging artists have never known a world without computers and therefore do not draw the lines of distinction that existed previously. What is incomplete is the art historical record.

Dr. Taylor selected *Gaussian-Quadratic*, created in 1962-63 by A. Michael Noll, to set the tone for the exhibition and establish the line as a key component of digital art. Noll was a researcher at Bell Labs, which was a vital center for the development and exploration of computer art and music. The exhibition then highlights Jean-Pierre Hébert, who began working with conceptual algorithmic art in 1974. His work has appeared in seventeen SIGGRAPH Art Shows. In 1995, he co-founded "The Algorists" with Roman Verostko, and they were joined by Hans Dehlinger, Helaman Ferguson, Manfred Mohr, Ken Musgrave, and Mark Wilson. Technically, Hébert's work rests on simple coding informed by geometry, mathematics, physics, and great attention to rendering details. Some of his concepts stem from Zen Buddhism and a spiritual approach to life. In my book *Art of the Digital Age* Hébert states, "For twenty years my personal endeavor has been to create new kinds of drawings, where my mind or my eyes or my hand would no longer be a limit." In addition to six of his prints, the exhibition includes works from *Artist Book: Twenty-Four Views of the Metagon* and *Sand Installation: Ryōan-ji,* which explores ephemeral patterns in the sand made through digitally controlling a steel ball.

Beginning his creative career in the late 1950s as a jazz musician and painter, Manfred Mohr initially focused on gestural abstraction. In 1962, he began the exclusive use of black and white as a means of visual expression. After discovering Professor Max Bense's information aesthetic, his art transformed from abstract expressionism to computer-generated algorithmic geometry. The influence of mathematics and music gives his work a core essence of rhythm and repetition. In 1972, Mohr turned to sequential drawings of the fixed structure of a cube, and made his first computer-generated films. He renewed his work on the 4D hypercube in 1987, and began to use color in 1998 to show the complexity of the work through differentiation. Four years later, he designed and built small PCs to run his program "space.color," and in 2004 wrote the program "subsets." The resulting images are visualized on LCD panels in slow, non-repetitive motion. His latest software "Artificiata II" creates digital paintings and animations that are based on the eleventh- to thirteenth-dimensional hypercube and uses diagonal paths as graphic elements. The animation algorithm contains random variations of speed and suites of stills, adding a musical rhythm to this work. The five artworks by Mohr in this exhibition range from black-and-white plotter drawings to color prints and computer-based animation. According to Mohr on his website, "The computer became a physical and intellectual extension in the process of creating my art. I write computer algorithms, i.e., rules that calculate and then generate the work, which could not be realized in any other way. My artistic goal is reached when a finished work can dissociate itself from its logical content and stand convincingly as an independent abstract entity." Mohr won the Golden Nica from Ars Electronica in 1990, which is the highest award a digital artist can receive.

Roman Verostko maintains an experimental studio where he has developed original algorithmic procedures for creating his art. Active as an exhibiting artist since 1963, his earliest use of electronics consisted of synchronized audiovisual programs dating from 1967. Recipient of the Golden Plotter Award in 1994, he began experimenting with programming and exhibited his first coded art in 1984. By 1987, Verostko had modified his software with interactive routines to drive paint brushes mounted on a pen plotter's drawing arm. Examples of his algorithmic plotter work include the *Pathway* series, *Pearl Park Scriptures, Diamond Lake Apocalypse,* and *Manchester Illuminated Universal Turing Machine,* produced in honor of Alan Turing. When referring to his creative work, Verostko says, "I have sought to create original forms that are unique realities without reference to other objects or images. My pursuit followed the lead of those pioneers who wanted to create art using visual form much like a composer creates music with audio form." His earliest image in this exhibition is from the 1990 artist book "Derivation of the Laws" by George Boole. The illustrations evolved from procedures and algorithms made possible by Boolean logic. Four other works showcase Verostko's command and control of line and color as expressive forms of digital art. Also included is a documentary showing the process of how his images are created.

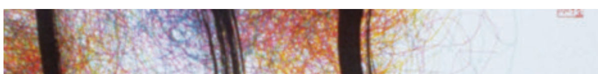


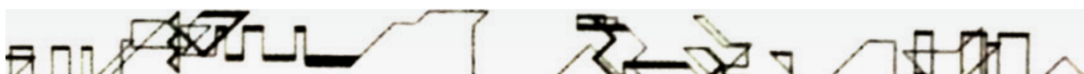
I first became aware of Mark Wilson's creative work at the Small Computers and the Arts Conference in Philadelphia in 1990. I was so impressed that I recommended he join the MFA Computer Art Department at the School of Visual Arts, where he taught from 1991 to 1995. A decade before, Wilson purchased a microcomputer and learned programming with the goal of creating artworks. The National Endowment for the Arts awarded Wilson an Artist Fellowship in 1982, and the Connecticut Commission on the Arts has given him three grants. He received Distinction and Honorable Mention Awards from Ars Electronica, and the Golden Plotter Award in Gladbeck, Germany.

In addition to the New York Digital Salon, each of the artists in the exhibition has been recognized by such organizations as the National Endowment for the Arts, various granting agencies and digital art groups, including ACM SIGGRAPH, Ars Electronica, and ZKM. Public and private collections are stimulating an increased interest in digital art and its history. More than half of the images in this exhibition are on loan from the Anne and Michael Spalter Digital Art Collection, one of the largest private collections of early digital art in the United States, and others are courtesy of the artists. One of the most comprehensive collections of digital art resides in the Victoria & Albert Museum, London. Overseen by Douglas Dodds, Senior Curator for Computer Art and Head of Central Services in the Word and Image Department, this collection dates back to the 1960s and includes the Patric Prince archive. Prince is an American art historian who actively collected early digital art. Another large component of the V&A collection is from the British Computer Arts Society.

Exhibitions of digital art have been presented by the Victoria & Albert Museum in London, MoMA in New York City, Centre Pompidou in Paris, and the Museo Nacional Centro de Arte Reina Sofia in Madrid.

For the past twenty years the New York Digital Salon has brought attention to the art form and helped fill in the gaps in contemporary art history. As the Curator for the first three exhibitions and the Director of the Salon for the past fifteen years, it has been a rewarding journey to see digital art take its rightful place in the twenty-first century art scene.



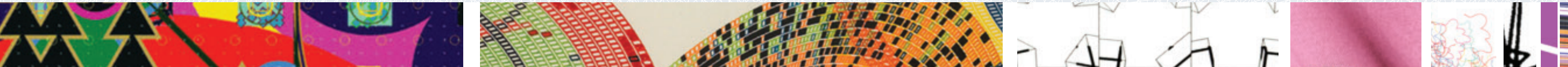


The Algorist Manifesto

```
if (creation && object of art && algorithm && one’s own algorithm) {
     include * an algorist *
} elseif (!creation || !object of art || !algorithm || !one’s own algorithm) {
     exclude * not an algorist *}
```

Jean-Pierre Hébert, 1995[1]

[1] Written by Jean-Pierre Hébert following the 1995, LA SIGGRAPH conference and published online.



Linearity and the Algorithmic Search

Dr. Grant D. Taylor
Associate Professor of Art History
Lebanon Valley College

There is a simple elegance to an algorithm. Precise, logical, and finite, this step-by-step procedure is an effective tool for solving mathematical problems. In the form of a computer program, however, the algorithm becomes something else entirely. As a computational procedure, the algorithm holds immense procreant power, a type of engine that can generate a universe of visual form. The algorithm quoted on the previous page is not written to generate artistic form, but is a descriptive announcement of an artistic movement—an abstract machine for processing artists. Written by artist Jean-Pierre Hébert, this succinct statement represents one of the most unique manifestos in the history of art. Similar to other twentieth-century manifestos, it declares a set of guiding principles that a group of like-minded artists have agreed upon. Lacking the rhetorical flourishes and the heated ideological prose of other well-known modernist manifestos—the Futurists and the Surrealists immediately come to mind—this one is written in computer code. Although the artist's intentions and motives are somewhat obscured by the rule-based language of programming, the declarative statements remain decipherable even to the layperson. In algorithmic form, the manifesto states the necessary prerequisites for being considered an Algorist. Put simply, if you create art with an algorithm of your own design (if, in other words, you write your own computer code), you are an Algorist. If you do not use your own algorithm, you are not. The artists in this exhibition are Algorists in the truest sense. Jean-Pierre Hébert, Manfred Mohr, Roman Verostko, and Mark Wilson, have spent their entire careers exploring the vast creative potential embedded in the algorithmic process. Bringing together for the first time a collection of the artists' masterworks, *The American Algorists: Linear Sublime* attempts to investigate the core visual element that connects these artists—the line. Using the generative processes allowed by digital computation, a totally unique mode of artistic production has provided this group of artists with a pathway to limitless forms of linear expression.

Mark Making: Ancient to Digital

The act of making a single mark is primordial. We can imagine the first moment when the earliest humans attempted the first pictorial act, a representation of something outside ourselves—real or abstract. Whether they were contour lines forming the silhouettes of various animals on darkened cave

walls, or the carved single-path line of the ancient labyrinth pattern, the line appears as our first pictorial structure. Indeed, there is something magical about the line. As David Rosand has written, a line upon a surface "immediately transforms that surface, energizes its neutrality." [2] The trace, for Rosand, transforms the flatness of the ground into a kind of "virtual space" where the act of drawing effectively "translates the material reality into the fiction of imagination." [3] Chinese calligraphers speak of the "generative" charge when the mark activates the surface of paper. The single, unbroken line contains within it a uniqueness that differentiates it from other forms of mark-making. For example, the continuous line, with its extended intentionality, acts as the trace or presence of the artist. The extended line has a temporal element; longer in form, the line journeys through time and space, building a kind of narrative of existence. There is also the performative aspect of making the mark—the physicality of gesture—which in the history of art from Leonardo da Vinci to Pablo Picasso to Jackson Pollock has been defined as the ultimate act of the artist—the definable act of genius.

The line has a storied history. For the ancient Greeks and Romans, the ability to produce a line of particular quality was proof of artistic skill and standing. In Pliny the Elder's anecdote of Apelles' and Protogenes' famous drawing competition, the older Master, Apelles, is confronted by an example of fine draftsmanship by Protogenes, the younger up-and-coming artist. After a series of artistic exchanges in which lines are rendered with ever more dexterity, the younger artist in the duel finally admits defeat and pays homage to Apelles. Thus, the perfectly rendered line is a kind of index, a trace of individual genius. Other stories emerged in the Renaissance, such as Giorgio Vasari's apocryphal tale of Giotto's demonstration of mastery of the perfectly drawn circle. Though not part of a competition between rivals, Giotto responds to a request from the Papacy to submit work for consideration. With bombastic flare, Giotto gives the emissary a freehand drawn circle. Again, brilliance is shown in the form of a single drawn line. In this case, Vasari describes in detail the physical act of the performance, giving an account of Giotto steadily and deliberately transforming himself into a human compass, rendering with mechanical precision the circle. Since then, the perfectly rendered circle has become symbolic of artistic virtuosity, appearing, for example, in the background of one of Rembrandt's most famous self-portraits.

By the second half of the twentieth century a new kind of line was drawn, one that surpassed the precision of the ancient masters. However, this line did not flow

[2] David Rosand, *Drawing Acts: Studies in Graphic Expression and Representation* (New York: Columbia University Press, 2001), 1.
[3] Ibid.

from the movement of a human hand. This line was a result of an algorithmic process in which a human programmed the digital computer to generate a complex array of lines that were then graphed or plotted on an electronic screen. In these very first examples of computer art we find the basic image-making properties at work and identify the beginnings of a unique type of linear aesthetic that would provide the basis for the entire oeuvre of the Algorists.

When first viewing *Gaussian-Quadratic* (fig. 1), the viewer is struck by the artwork's rudimentary line construction. Like the simple lines drawn by our paleolithic ancestors on the walls of Lascaux, this image feels primitive, especially when compared to the hyper-realism of digital images of today. *Gaussian-Quadratic,* one of the first digital artworks ever created, was produced in 1962-63 by A. Michael Noll, a scientist and engineer working at Bell Telephone Laboratories, the industrial research laboratory that would invent many of the foundational technologies of our digital culture. Noll came to computer-generated imagery by chance when a colleague's program erred and produced an unusual linear design. In the chaotic lines of his colleague's programming blunder, Noll saw abstract beauty. As a consequence, during the summer of 1962, Noll pursued art creation and generated a "series of interesting and novel patterns" on the IBM 7090 mainframe, the same model NASA employed to launch the first American astronaut into space.[4] *Gaussian-Quadratic* was one such design in this early series and, as with all early computer art, it was linear. The image's linearity is due to the vector graphics system, which was a newly developed digital imaging system based on the foundational concepts of Euclidian and Cartesian geometry, and it is this vector system that remains

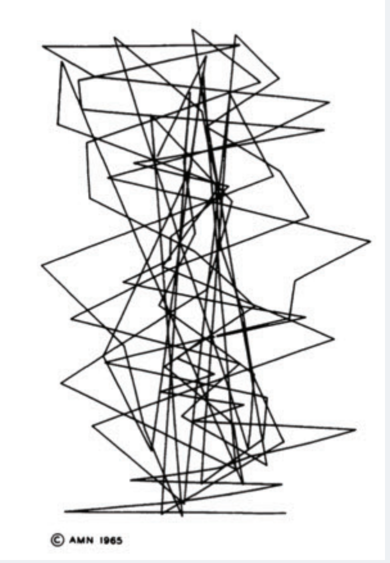
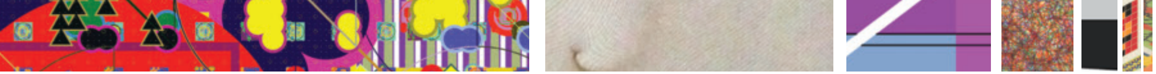


Figure 1
A. Michael Noll, *Gaussian-Quadratic,* 2003 copy of 1962-63 original IBM 7090, Stromberg-Carlson S-C 4020 microfilm recorder, 13 3/4 x 12 inches, Anne and Michael Spalter Digital Art Collection.

[4] A. Michael Noll, "Patterns by 7090," Bell Labs Technical Memorandum, August 28, 1962.



at the core of the Algorists' practice today. Conforming to the long history of vectors in mathematics, computer graphic engineers in the 1960s considered a vector a geometric entity, commonly a line segment defined by length and direction. In its simplest Cartesian form, a line is the locus of a point and, as such, traces the progress of points through geometric space. Noll employed the Cartesian coordinate system for defining the length and direction of all the lines in *Gaussian-Quadratic*. Using numerical coordinates, a way to describe the location and shape of objects in Cartesian space, Noll recorded certain points on the x and y axes through which vectors—also called paths, or strokes—would pass. Indeed, the word 'vector' originates from the Latin *vehere* meaning 'to carry.' There is a dynamic notion to the vector; a directional movement that reminds us of Paul Klee's famed description of drawing in his *Pedagogical Sketchbook* (1925). For Klee, drawing is taking a line for a "walk."[5] The equivalent in early computer graphics was to plot the line and record the line's movement through each point of the vector. Hence, the earliest drawing device, a mechanical instrument that did not require the intervention of the human hand, was called a plotter.

Directing the computer to make a simple drawing by specifying the numerical points through which a line would pass was an exceedingly difficult task at the dawn of computing. Even a simple closed circuit polygon, which is what *Gaussian-Quadratic* essentially is, took months of programming. But simple linear shape building was not what interested Noll. Introducing a variable, an algorithm that had a randomizing effect on certain coordinates in his vector space, attracted the engineer. *Gaussian-Quadratic* was a result of his research into the visual effects of programmed randomness, the mathematical title stemming from the line segments having a Gaussian curve distribution. For Noll, randomness was a procedure with which to disrupt the predictability of the computer. Early in the computer's development, Allan Turing, the father of modern computing, recorded in his seminal 1950 essay, *Computing Machinery and Intelligence,* that an interesting variant in a digital computer was the random element, which allows the computer to make unpredictable and arbitrary selections without subjective involvement, an attribute not possible in humans. Such random behavior in computation, what early computer art theorist Herbert Franke called the "generative impulse," could provide an engine for a universe of new and unexpected forms, patterns unimaginable even by the artist who created the algorithm.[6] Noll recognized early that randomness was more than a metaphor of creativity; it was the actual

[5] Paul Klee, *Pedagogical Sketchbook* (1925; reprint, New York: Nierendorf Gallery, 1944), 1.1.
[6] Herbert Franke, *Computer Graphics—Computer Art*, trans. G Metzger (New York: Phaidon, 1971).

means for realizing digital production.[7] The computer could become a creative actor. Using random numbers to determine where and how to place graphic elements allowed the artist to produce new aesthetic configurations, a repertoire of designs from which the artist could make an aesthetic decision, eventually choosing the parameters that were producing the most interesting linear forms. From the different permutations generated, the artist would then choose the most aesthetically satisfying. *Gaussian-Quadratic* was chosen because this particular abstract design resembled the Cubist infrastructure of Picasso's *Ma Jolie,* one of the engineer's favorite paintings in the Museum of Modern Art.

Random generators provide the animating force behind all the Algorists' early linear drawings. *Program 21,* one of Manfred Mohr's early drawing algorithms, exhibits this random factor (fig. 2). Mohr's career

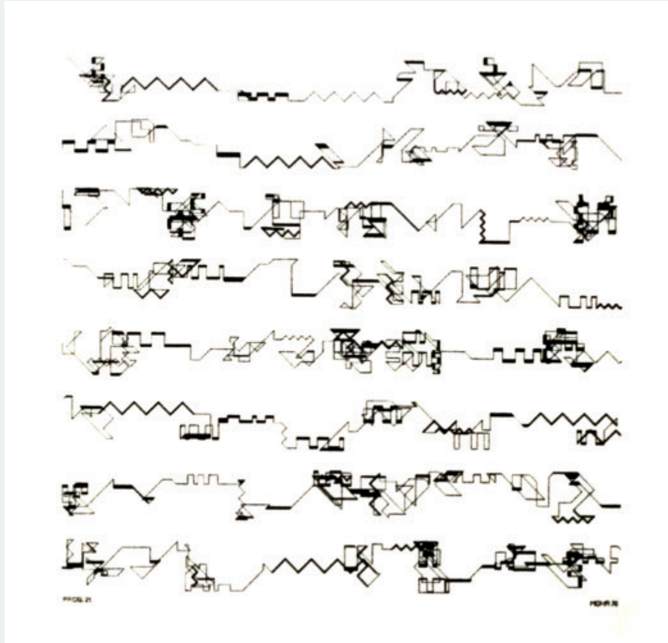


Figure 2
Manfred Mohr, *Program 21,* 1970, plotter drawing, 20 x 20 inches, Anne and Michael Spalter Digital Art Collection.

[7] A. Michael Noll, "The Digital Computer as a Creative Medium," *IEEE Spectrum,* vol. 4, no. 10 (1967): 89-95.

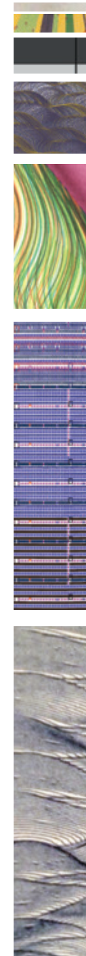
is long and astonishingly rich. Born in Pforzheim, Germany, Mohr attended Kunst + Werkschule in Pforzheim and then École des Beaux-Arts in Paris. Although an action painter and jazz musician, Mohr gravitated towards geometric abstraction after studying in Paris and reading the latest theories from the German semiotician Max Bense. After an intensive study of the semiotician's writings on "generative aesthetics," Mohr became an exponent of Max Bense's theory, adopting his term 'generative art' to describe his own work. Mohr's foray in computing coincided with the social and cultural shifts of late 1960s Paris, a volatile period of civil unrest and student demonstrations. After teaching himself the art of programming, Mohr would co-found the seminar *Art et Informatique* at the University of Vincennes, the institution where he first gained access to the computer. Mohr would be one of the first trained artists to use the computer. Drawings from *Program 21* were shown at Mohr's first solo exhibit of computer-generated art at Musée d'Art Moderne de la Ville de Paris in 1971. The exhibit, entitled *Manfred Mohr Computer Graphics: Une esthétique programée,* was the first major exhibit of computer art by a single artist (fig. 3). These drawings mark Mohr's early experiments with randomizing programs, what he called "aesthetical-filters," that would create a playfully rhythmic line, not unlike a piece of improvised musical notation. Choosing different line characteristics, the artist created an alphabet of arbitrary elements that, when plotted, generated a number of square waves and zig-zagging lines that seemed to walk randomly across the paper.

Figure 3
Manfred Mohr demonstrating *Program 21* on a flat-bed plotter, 1971, Musée d'Art Moderne de la Ville de Paris.

Public Reception

In April, 1965, *Gaussian-Quadratic,* along with other work by fellow Bell Labs employee Bela Julesz, was put on display at the Howard Wise Gallery in New York City in the first computer art exhibition in the United States. Although the exhibition was a significant landmark, and generated a certain amount of technical interest, the criticism ranged from "cool indifference to open derision."[8] The *New York Herald Tribune* denounced the works as "cold and soulless," a criticism that would continue to haunt future computer art.[9] When artists like Mohr began using the computer, critics saw it as just another example of the vulgarization of science, in which infatuated artists, flirting with the latest scientific and technological media, produced what was equivalent to scientific kitsch. Exhibitions were often "condescendingly reviewed," as though the medium were "without serious intent or noble aspiration."[10] The presentation of early computer art is marked by a variety of aggressive behaviors that include the sabotaging of computers and physical attacks on artists. The most famous incident happened to Mohr in 1972. When invited to give a lecture about his revolutionary art practice at the Sorbonne, the artist was faced with violent reactions from students who viewed the computer as a corrupt instrument of capitalist power and control. They even threw eggs at him.

The reasons for this anti-computer sentiment are complex. The U.S. military and corporate research laboratories, those institutions with the latest mainframe technology, were the first crucibles of computer art. Furthermore, scientists—not artists—were the first creators of computer art. As such, computer art encapsulates much of the technocratic vision and the scientific pragmatism of the post-World War II period. Shaped by military prerogatives and scientific ideals, computer art naturally grew against the grain of traditional fine art practice, and the dominant humanist tradition within the art world reacted negatively to this new media interloper. With fresh memories of the mechanized atrocities of the two World Wars, many found the appearance of the computer in the sanctified realm of fine art as another unwelcome incursion by modern science and sought to admonish computer art for its dehumanizing tendencies. Effectively, the scientist and technologist were criticized for introducing the ultra-rational and now semi-autonomous computer into a domain broadly dominated by romantic and existential humanism, which held up artistic genius and human intuition as the cornerstones of creativity. Noll had shown that the computer could become the ultimate research tool, an instrument with the power to explore the very nature of art. Other scientists and technologists were more direct, believing that mathematical formalization, essentially turning the artistic process into an algorithm, could finally purge art of its primordial mystique. The computer would prove that fine art was no longer the domain of the "artistic genius," or, as Immanuel Kant suggested, "a talent for producing that for which no definite rule can be given."[11] Many feared that one



[8] Cynthia Goodman, *Digital Visions: Computers and Art* (New York: Harry N. Abrams, 1987), 25.
[9] "Computer-Generated Pictures," *The New York Herald Tribune,* 10 April 1965, 8.
[10] Philip J. Davis and Reuben Hersh, *Descartes' Dream: The World According to Mathematics* (Sussex: The Harvester Press, 1986), 48.
[11] Immanuel Kant, *Critique of Judgement,* trans. J. C. Meredith (Oxford: Clarendon Press, 1952), 168.

day this digital surrogate could replace the artist entirely.

The Algorists

By the 1970s, when many of the pioneering artists of the Algorists first began employing the digital medium, the computer was a rising symbol of the Cold War, a kind of dutiful machine serving the all-powerful military industrial complex. As such, the negativity surrounding computer art permeated the artists' early careers. By the end of the 1980s, the general malaise concerning the state of computer art reached a critical point. The proliferating nature of digital technology meant new forms were perpetually surfacing and rapidly diversifying. No technology has ever unfurled its potential as swiftly as computers. In contrast to traditional tools that retained their form and function for hundreds of years, the computer changed dramatically in a short space of time. The computer as a singular type of technology—a medium defined by a physical machine—was beginning to change. Art employing the latest digital technologies no longer relied on the early mainframe computers, but was embedded in multiple devices, interacting globally with mobile and web-based technologies. The age of the Internet had dawned. Indifferent to the term 'computer art,' as all the members of the Algorists were, practitioners began seeking new names to define digital practice. The term 'digital art,' which is the term most widely used today, suggested a comprehensive process without linking the computer—the hardware itself—directly to the art. The term broadened the definition, and placed emphasis on an overall technological process rather than a particular medium.

The Algorists formed in this shifting environment. Unhappy with the broad meaning produced by 'digital art,' a term now linked to a dizzying array of digital practices, and repelled by the term 'computer art,' a term that had become heavily maligned, Hébert and Verostko eventually neologized a term that was specific to their methodology. Foremost in the minds of these pioneering artists was the desire for a term that differentiated themselves from the new generation of digital artists who did not write their own algorithms. The Algorists had witnessed over the previous decades the development of the Graphical User Interface (GUI), a graphic system that sought to humanize the computer by allowing the individual—eventually called 'user'—to navigate the computer using familiar metaphors and icons. Our media devices today show the result of this user-centered shift. Importantly, the new consumer did not have to wrestle with the internal structures of the machine, such as its complex symbolic and command-line system. The complexities of the computer were hidden. Software engineers created

art-based graphic programs based on the new user-friendly interfaces, which eventually became the paint system, electronic palettes, and image synthesizers of the 1980s. The most enduring image manipulation software, Photoshop, was released in 1990. By embodying traditional media, the new interfaces rendered the computer monitor a window onto a simulated canvas. Therefore, artists could approach the computer with their visual arts training intact without requiring recondite computer programming knowledge. For the first time, artists interested in using the computer would not necessarily need to script or prefigure their art ideas into coded, algorithmic form, a process that had been at the center of digital practice for over two decades. However, the Algorists were thoroughly invested in the traditional algorithmic mode.

While the concept of the algorithm had been theorized by Verostko at conferences in Europe and Australasia since the mid-1980s, it was in Los Angeles that the group finally coalesced.[12] Like many new art movements, the Algorists formed at the outermost peripheries of the art world. Although there are a myriad of venues today for digital art, in the early 1990s computer artists were ostensibly marginalized by the mainstream art world, which meant they took refuge in a handful of organizations that valued and supported their work. One of the most popular organizations, which was an outgrowth of the expanding computer graphics industries of the 1970s, was SIGGRAPH (an acronym for the special interest group on computer graphics), and it was in this venue where the Algorists found their *Salon des Refusés.* Under the leadership of artists Verostko and Hébert, the Algorists would formalize at the 1995 Los Angeles SIGGRAPH art exhibition. These two artists would later win the organization's most prestigious art awards in 2009 and 2012 respectively.[13] At the conference panel entitled *Algorithms and the Artist,* the creative potential of the algorithm as a generator of artistic form was theorized and debated by Stephen Bell, Peter Beyls, Brian Evans, Ken Musgrave, Hébert, and Verostko.[14] Hébert recalled a heightened sense of congeniality among this gathering of artists, while Veroskto felt a passionate desire to give proper identity to a unique practice, a working methodology he had intellectually engaged with for more than a decade. The works in the exhibition were outstanding, too. Hébert's intricate single-line plotter drawing, *Un cercle trop étroit* (fig. 4), was on display at this pivotal event. The artist's intricately rendered plotter drawing produced a mesmerizing fluid ripple effect as blue translucent waves radiate outwards to the edge of the paper. Through exploring various mathematical functions, including the intricate calculus

[12] Although Verostko's seminal paper "Epigenetic Painting: Software As Genotype, A New Dimension of Art" presented at Utrecht in 1988 (The First International Symposium on Electronic Art) was an early treatise on the algorithmic method, the artist had been lecturing on the subject as early as 1982.

[13] *The Distinguished Artist Award for Lifetime Achievement in Digital Art.* Recipients were Roman Verostko in 2009 and Jean-Pierre Hébert in 2012. Manfred Mohr will be the recipient of the award in 2013.

[14] *Algorithms and the Artist,* Panel Discussion, SIGGRAPH 1995, Conference Proceedings, Panelists: Stephen Bell, Peter Beyls, Brian Evans, Jean-Pierre Hébert, Ken Musgrave, and Roman Verostko.

Figure 4
Jean-Pierre Hébert, *Un cercle trop étroit,* 1995, plotter drawing, ink on paper, 35 x 25 inches, artist's collection.

of fractals, the artist was able to create strange, wavelike force fields, a kind of atmospherics that perfectly balanced asymmetric and symmetric linear arrays. Incredibly, the entire form is created from one single line.[15]

In consultation with Verostko, Hébert suggested the name "Algorists" for the group, a term influenced in part by Donald Knuth's 1968 canonical computer-science text, *The Art of Computer Programming.* Hébert recalled that in tracing the history of the algorithm in the first chapter, Knuth mentions the famed debate between the Abacists and Algorists. This controversy, which centered on the best system to perform basic arithmetic, lasted through the medieval period and into the Renaissance (fig. 5). The so-called Abacists supported the Roman numeral system which relied on the abacas (*tabula logisctica*) for calculation, while the Algorists used the *algorism* technique employed in the Hindu-Arabic numeral system, which involved decimal notation (pen and paper calculations) and the power of the algebraic zero.[16] Following the conference, Verostko, who had experience as an encyclopedist and art historian, would carefully trace the complex etymology of the word 'algorithm' back to the ninth-century Persian mathematician Mohammed al-Khwârizmî who is credited with providing the step-by-step rules for adding, subtracting, multiplying, and dividing ordinary decimal numbers. For the movement's founders, Mohammed al-Khwârizmî was the first Algorist and proof that the concept had ancient lineage.

There was something in the controversy between the Abacists and the Algorists that resonated with Hébert. The Algorist Manifesto, shown on page 6, embodied a similar sense of division. Newly developed software programs, like Photoshop,

[15] Hébert's lines often come in two forms. While both are mathematically continuous, some are uninterrupted and unbroken; others break momentarily so as to conform to the four-sided edge of the composition.
[16] Williard E. Stone, "Abacists versus Algorists," *Journal of Accounting Research,* vol. 10, no. 2 (Autumn 1972): 345-350.

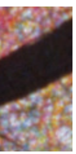
Figure 5
Algorists vs. Abacists, from Gregorius Reisch, *Margarita Philosophica* (Freiburg, 1503).

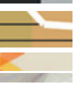
allowed for endless play with techniques of collage and pastiche that mimicked all previous artistic styles and mannerisms. Yet the consequence of the interactive visual interface was that artists had little conscious understanding of the underlying structure of the computer and its processes, an awareness the Algorists believed you needed to fully comprehend the potential in computational art. Artist-programmers were disenchanted with the commodification of computer art, believing the new off-the-shelf software produced a kind of low quality 'canned art.' For Musgrave, an early member of the Algorists, the algorithmic imperative was the purest form within computer art, and because the computer had depth that could only be perceived by those with deep knowledge of computation, many others believed that artist-programmers were the only ones capable of recognizing true beauty in digital forms. The theorist Roger F. Malina argued that commercial programs embedded a recognizable "signature" in the artist's work that was not their own, a mere trace of the software company.[17] Effectively, computer art had split into two factions: the orthodox artist-programmers who used programmatic techniques, and those artists who employed commercial software as a tool to an artistic end. The schism that emerged was, as Donald Michie and Rory Johnston described, "every bit as vehement as the rivalry between painters and sculptors in Titian's day." [18]

It was not just the traditional form of practice—writing your own code—that the Algorists felt uneasy about. The key technology for early computer arts, the pen plotter, was becoming obsolete. As the first graphic technology of the modern computer, the plotter had remained central to the Algorists' practice. Pen plotters generated an image by moving a pen across the surface of paper, essentially drawing a line through those numerical coordinates defined along points on the x and y axes. The plotter, with its mechanical arm and linear stroke, was more of a drawing machine

[17] Roger F. Malina, "Computer Art in Context of the Journal Leonardo," *Leonardo* Supplemental Issue (1998).
[18] Donald Michie and Rory Johnston, *The Creative Computer: Machine Intelligence and Human Knowledge* (Harmondsworth: Viking, 1984), 147.







than a printer. Algorist Mark Wilson called the plotter the “most venerable device” to have been used in the service of computer art (fig. 6).[19] By the 1990s, Hébert, Mohr, Verostko, and Wilson were masters of the medium. But for many in the digital arts, in particular those who worshipped emergent technologies, the plotter seemed antiquated, especially with the new screen-based, interactive, and virtual interfaces of the early 1990s. As the plotter was becoming obsolete, the Algorists grew more intent on recording for prosperity this unique mode of production. Thus, what makes the formation of the Algorists interesting is that it does not announce a new methodology, something common to Modernist manifestos, but rather attempts to cement a traditional mode against the ever-changing dynamics of digital technology.

While the Algorist manifesto appeared to occlude many artists, it was very open. If you created your art using an algorithm—digital or otherwise—you could be considered an Algorist, though some members believed the true power of the algorithm was in its digital form. The manifesto in code meant there was no formal membership. In actuality, the movement was retroactive, in that Verostko identified a variety of artists within history who conformed to the algorithmic ideal. The movement was also more virtual than physical, marking it as the first art movement of the digital age where cyber presence was essential. Correspondence, debate and discourse were spread widely across the artists’ websites. In fact, the Algorists, with their deep knowledge of programming, were the first artists in the world to build a web presence around their practice, a common feature of every artist working today. Via the Internet, the Algorists increased in numbers through virtual affiliations. A group in Paris, twenty to thirty strong, asked Hébert if they could call themselves “les algoristes,” the French version of the Algorists. Other artists in Germany and England also began identifying themselves with the Algorists, all discoursing electronically.

Figure 6
Wilson changing pens and inks on an IBM 7585 pen plotter, Computer Model: IBM PS/2, artist’s studio, West Cornwall, 1987.

[19] Mark Wilson, *Drawing with Computers: The Artist’s Guide to Computer Graphics* (New York: Perigee Books, 1985), 32.

New American Narrative

Since its inception in the 1960s, digital art was largely defined as international in scope, largely a result of the development of the modern computer taking place simultaneously in advanced industrial nations. From the beginning, digital artists and their proponents have proudly resisted any attempt to align digital practice to a single national identity, preferring to celebrate the particular universal nature of the digital process and how its different modalities have collapsed geographical boundaries. Indeed, the artists in this exhibition would not define themselves as American artists—it would seem unnatural to do so, even though they have lived in the United States most of their lives. Perhaps more so than most Modernist movements, the Algorists embody the very notion of the internationalist. They were global artists before the age of global art. In reality, most of the Algorists, some American-born, others European, have led a peripatetic existence, continually traveling between Europe, Asia, and America. Also, their non-objective art has no discernible traces of American life—no figure or landscape that further contributes to the discourse of national identity. Moreover, their success and acclaim has been more acutely felt in Europe than in the United States. However, the title of this exhibition, *The American Algorists*, intentionally challenges that common conception of the digital arts as innately transnational in character. Although it may appear incongruous to include the Algorists within the story of American art, there are many reasons to do so.

It is not enough to say that each of the Algorists has spent most of his career in the United States, or that Mohr was elected a member of the American Abstract Artists in 1997. While on the surface their non-objective art appears

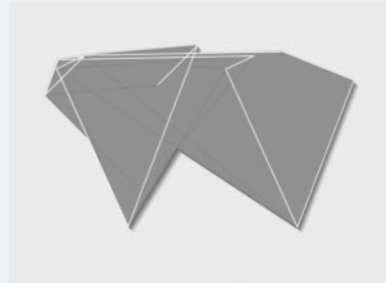


Figure 7
Manfred Mohr, *P511-N,* 1997, computer calculated drawing on acrylic/canvas/wood, 40 3/16 x 66 15/16 inches, artist’s collection.

devoid of national sentiment, one cannot escape the feeling that these artists’ abstract works somehow reverberate with the landscapes that surround their studios. Indeed, it is hard not to see in Mohr’s art the triangular lines and vertices of the Tribeca streets where the artist keeps his Manhattan studio (fig. 7); or see in Hébert’s beautifully oscillating wave lines the optical reflections made by the blue Pacific waters on the sandy shallows of Santa Barbara, visible from his studio house perched high above the sea (fig. 8); or see in Verostko's sinuous, chaotic lines the cracks and fissures of Diamond Lake, the water body behind the artist's studio that freezes in the Minneapolis winter (fig. 9); or see in Wilson's linear banding the strata of gneiss rock curving along the Housatonic River, the tributary in front of the artist's Connecticut studio (fig. 10).

While there may be subconscious echoes of place in their work, what connects the Algorists to the narrative of American art are their achievements as pioneers. Indeed, the artists' story has a certain quality that naturally lends itself to American myth. Pioneering self-taught artists struggling at the peripheries of the intractable world of early computing seem a fitting addition to the epic narrative of American art. After all, one of the most evocative characters in the American art narrative is the lonely artist charting the outer edge of the frontier, struggling to capture the mysteries of a vast and untamed landscape. Like the nineteenth-century artists of the Hudson River School, the Algorists were the first to explore a new frontier—not the expanding Westward territories of the New World, but the emergent digital terrain made possible by the modern computer. These were the first generation of artists to explore the creative pathways allowed by the digital computer, a technology largely developed in the United States. This technology was perhaps the greatest, most impactful invention of the twentieth century and a technology that fundamentally changed the economic and cultural fabric of the globe. But it is not just the epic struggle of artists encountering new territories that link these artists to the narratives of American spirit; the Algorists' work parallels the key theories that underpin our understanding of American art. Like their artistic descendants, the American landscape painters who recognized a spiritual core within the sublime power of nature, the Algorists have created a virtual world, one in which the algorithm, the basic unit of computational abstraction, has become exalted. Just as infinite and mysterious as the spiritual dimension

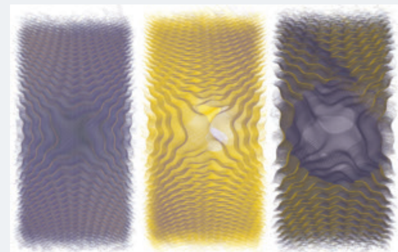


Figure 8
Jean-Pierre Hébert, *Triptych: Bright Wavelets 1-3,* 2008, inkjet drawing, pigments on Torinoko paper, 3 panels, 77 x 38 inches each, artist's collection.

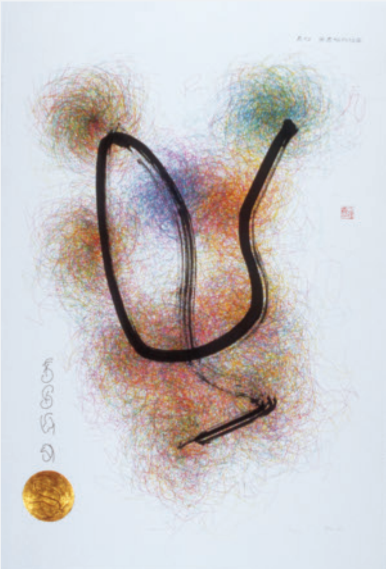


Figure 9
Roman Verostko, *Nested Swallow,* Version I, 1997, pen, ink and brush with gold leaf enhancement, 42 x 30 inches, Anne and Michael Spalter Digital Art Collection.

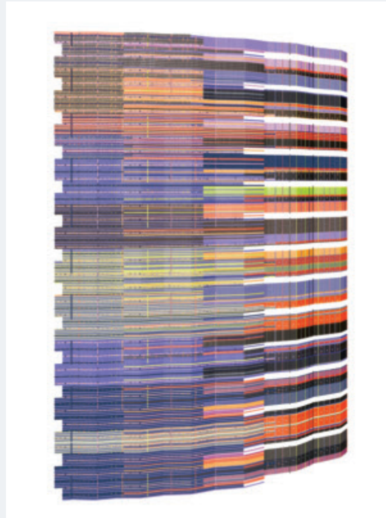


Figure 10
Mark Wilson, *PSC 32,* 2003, archival inkjet print, 57 x 45 inches, Anne and Michael Spalter Digital Art Collection.

underpinning God's natural world in the American sublime, the algorithmic process is for the Algorists a powerful generator of a vast, previously unimaginable world of geometric and linear form. When confronted with the complexity of algorithm and its linear forms, viewers are often confounded—indeed, the artists themselves are frequently surprised by the visual products of their algorithms. It is an art form that exceeds comprehension.

Aesthetics and the Generative Sublime

The notion of the sublime is useful when theorizing the aesthetic experience of algorithmic art. Employing a combination of the philosophies of two influential eighteenth-century philosophers, Edmund Burke and Immanuel Kant, European Romantics formed a robust aesthetic category for discussing our experience of nature and art. In *A Philosophical Enquiry into the Origins of Our Ideas of* *the Sublime and Beautiful* (1757), Burke described a set of sublime experiences that induce a kind of thrill or terror, a feeling of fear that was followed by a perverse pleasure, as opposed to the experience of beauty, which was soft and gentle. Kant had an even greater impact on the consciousness of artists and art theorists of the nineteenth and twentieth centuries. In his *Critique of Judgment* (1790), Kant argued that the sublime response was a result of the tension experienced when the mind attempted to apprehend the immensity or limitlessness of a concept. In the Kantian sense, sublimity is, as Philip Shaw described it, the "moment when the ability to apprehend, to know, and to express a thought or sensation is defeated."[20] However, in that defeat, the mind has a sense of what lies "beyond thought and language," a sense of the magnitude and impenetrability of existence.[21] Rejecting a picturesque, charming and contained vision of nature, Romantic artists—including some of the most prominent American landscape painters of the Hudson River School—imagined nature at its most forcefully sublime. Through viewing such unsettling images—pictures of tempests, shipwrecks, and vast landscapes—the aesthetic experience could rapidly move toward the transcendental.

In the story of American art, discussions of sublimity took center stage again in the mid-twentieth century when the sublime was employed to theorize the phenomenological response to large, abstract paintings by a new generation of American artists, the Abstract Expressionists. When confronting their work, viewers would frequently describe the large canvases as mesmerizing, bewildering, even epic. Not since the Romantics had art evoked a kind of transcendence and exaltation in the spectator. In 1948, Barnett Newman, wrote a famous, yet esoteric, essay entitled *The Sublime Now,* in which he discounted much of the European interpretations of the sublime, advocating instead for a sublime that was not reliant on notions of God or nature, but on the single creative force of the artist. For Newman, and other exponents of Abstract Expressionism, there was nothing beyond the painted surface, just that all-important exchange between the painted field and the spectator's consciousness—a kind of primal response. The art critic, Harold Rosenblum, in his influential 1961 essay, *The Abstract Sublime*, found that "the confrontation with a boundlessness" linked the American painters of this new non-objective art to the Romantic sublime. In heroic terms, Rosenblum described four American painters as "masters" of a new "abstract sublime."[22] The art critic saw in the color fields and vertical stripes of Barnett Newman, the sheer magnitude

[20] Philip Shaw, *The Sublime* (New York: Routledge, 2005), 3.
[21] Ibid.
[22] Robert Rosenblum, "The Abstract Sublime," *Art News,* February 1961, 38-41.

and scale of plunging and cascading forms of Clifford Still, the dark and shimmering voids of Mark Rothko, and the cosmic and flowing energy of Jackson Pollock, a new abstract language.

When confronted with the linear complexities of the Algorists, many have described the same aesthetic response—a sense that the complexity of line and form is overwhelming, or that there is a crushing weight when contemplating the complexity of the algorithm that produced the artwork. Whether it is the *n*-dimensional hypercubes of Mohr, or the dizzying symmetry and self-similarity of Verostko's lines, or the intricate linear rhythms of Hébert composition, or the layered geometries of Wilson, there is often the feeling of a cognitive failure in the viewer, an inability to comprehend the astonishing power of computation. Here, the Algorists' artwork resonates with a particular type of technological sublime.

Rather than the traditional aesthetic of awe and wonder of the Romantics and the late-Modernists, recent critics have employed the technological sublime as a way to describe the disconcerting and disorientating effects of the digital age. Working within Kantian parameters, postmodern theorist Jean-François Lyotard labeled the destabilizing effect of today's global media-scape—a technological existence in which an extreme space-time compression often results in a type of "technological sublime." [23]

Wilson's artwork seems to capture this type of technological density, a kind of imprint of the abstract and physical complexity of the digital machine. American-born, he received his BA from Pomona College in Claremont, California, and his MFA from Yale University in New Haven, Connecticut. Following Jack Tworkov and Al Held, his primary mentors at Yale, Wilson moved his painting style away from the influences of Abstract Expressionism toward new forms of geometric abstraction. He was influenced in part by the New York City scene and the new forms of hard-edge abstraction being created by Frank Stella. Shifting his compositions away from the minimal simplicity of hard-edge abstraction, Wilson gravitated toward heightened forms of geometric and linear complexity. Influenced by the Pop artists' recourse to found material, he was intrigued by images with high levels of intricacy, such as engineering plans or electronic circuitry. For Wilson, there was beauty in the dense divisions and connective lines of chip diagrams and circuit boards. Such incommensurability triggered a unique type of aesthetic response. After years painting the intricate topography of structures, Wilson moved to the computer and plotter, a medium that could provide an extreme form of exactitude and precision. The

[23] Fredric Jameson, *Postmodernism, or, The Cultural Logic of Late Capitalism* (Durham: Duke University Press, 1991).

Figure 11
Mark Wilson, *SKEW FF10,* 1984, plotter drawing, 27 x 43 inches, Anne and Michael Spalter Digital Art Collection.

plotter would be able to render details far beyond the limits of human dexterity and handcraft. *SKEW FF10* (fig. 11), a large-scale early plotter drawing from 1984, juxtaposes line and shape in a three dimensional space. Floating half-circles, with intricate radial lines moving from the circles' center to their perimeters, overlap with similar forms in space. The segments in each semicircular shape remind us of the wedge-shaped sections, the *cunei,* of ancient Greek amphitheaters, but they also mirror the schematics of data segments on a computer's hard-drive disk. The artist's colors, all generated randomly, burn with a plastic intensity, fully resonating the artificiality of synthetic forms. More recently, Wilson's geometry has moved beyond the abstract beauty of the computer's inner hardware to a new type of spatial complexity. Using the latest ink-jet printer, Wilson builds a type of geometric tapestry of forms, what Douglas Dodds has recently described as a multidimensional matrix.[24] Printed on canvas, *e20808* (fig. 12) appears as a large, flat, almost impenetrable surface. However, on close observation the organizing armature—the grid—reveals lattices of form superimposed one on top of the other. The structural system is modular, based on an intricate configuration of line, shape, and color, all varying in size from the micro to macro.

[24] Douglas Dodds, *Code Matrix, 1985-2012,* Exhibition Catalogue (Galerie [DAM] Cologne, 2013).

Intricate in its layering, the image vibrates with a certain geometric tactility.

One of the key features of Wilson's methodology—the *modus operandi* that in fact ties the Algorists together—is the heuristic search. The Greek word *heuriskein* means 'to discover.' Heuristical methods have played an important part of problem solving in computer science, especially artificial intelligence research, which relied on heuristic procedures to provide solutions for systems with vast potentiality. What makes the Algorists' practice original is that each artist builds an individual art-making system that can generate an infinite amount of form, extending the production power of the

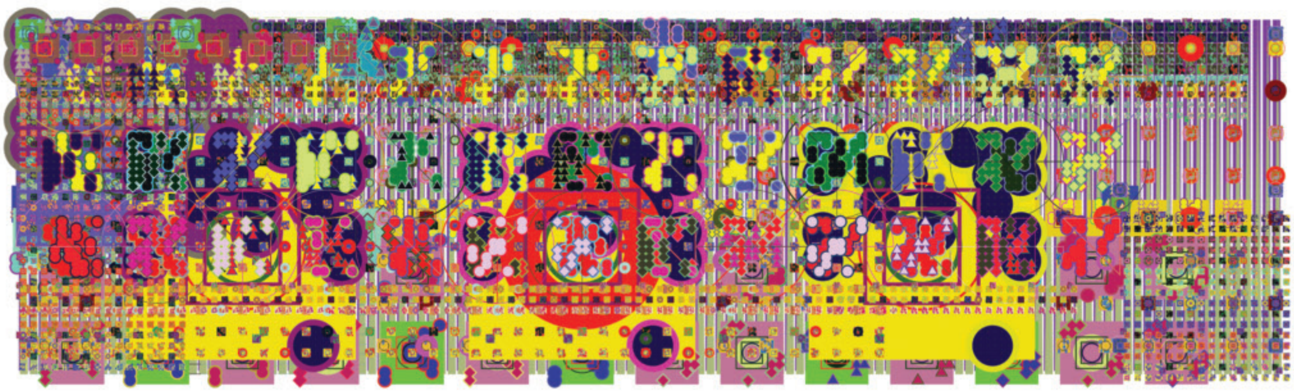


Figure 12
Mark Wilson, *e20808,* 2011, archival inkjet print on canvas, 40 x 120 inches, artist's collection.

artist by doing the work of thousands of people and creating limitless variations on a single idea. In addition, the computer, vested with the artist's generative algorithms, imagines forms that were beyond the artist's mental and productive capacity. In many cases, the field of logical potential—the theoretical space described by the algorithmic system—is infinitely large. Every artwork in this exhibition is but one, chosen by the artist, out of the innumerable. The abstract form is not so much created as discovered. The Algorists' practice becomes a project of meandering—sometimes haphazardly, other times methodically—through paths and lines of the possible.

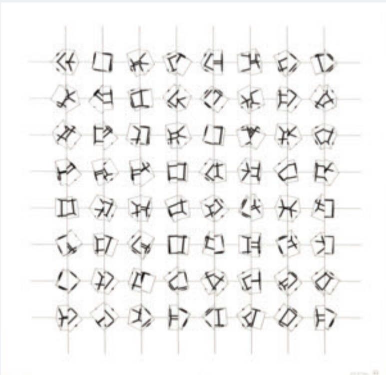


Figure 13
Manfred Mohr, *P-197a,* 1977, plotter drawing, 24 ½ x 24 ½ inches, Anne and Michael Spalter Digital Art Collection.

Mohr, too, describes his practice like a journey, stating that "only the starting point and a hypothetical destination is known. What happens during the journey is often unexpected and surprising."[25] Since 1973, Mohr has been exploring the linear structure of a cube, its simple straight lines becoming the artist's visual vocabulary. What interested Mohr were the two-dimensional signs, what the artist called *êtres-graphiques,* that resulted from fracturing the twelve lines of the cube. In Mohr's plotter drawing *P-197a* (1977) we see the artist's desire to break the absolute symmetry of this most simple platonic form (fig. 13). Mohr's cubes are divided into two parts by one of the Cartesian planes. For each image, the two partitions contain independent rotations of a cube. By rotating both parts of these cubes in small increments, essentially splitting the cube, long sequences of linear designs develop. Mohr increased the complexity of his linear constructions by systematically exploring ever higher dimensions of the cube. From a three-dimensional cube, which has twelve lines, Mohr sought to explore the fourth, the fifth, and the sixth dimensions of the cube, what in geometry is commonly called the 'hypercube.' This difficult mathematical construct essentially extends the cube in Cartesian space allowing for more complex linear structures to emerge. Mohr does not show the whole armature of the *n*-dimensional cube, which would be a mere mathematical visualization,

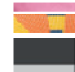
[25] Manfred Mohr, *Artist Statement 2000*, available from http://www.emohr.com.

but rather he shows the interaction of lines within sections, or subsets, of the system. *P511-N*, completed in 1997, is a result of exploring the sixth dimension of a hypercube (fig. 7). While the hypercube is a complicated system of connections, you can, as Mohr suggests, "walk through its lines" by calculating the line's path, a connection between two opposite points in the structure.[26] The artist called these lines "diagonal paths." Mohr's algorithm generates a repertoire of billions of possible diagonal-paths through the cubic structure from which the artist will choose. In *P511-N* one such diagonal path is represented in the white heavier line. The algorithm also generates lines that form interesting shapes, in this case non-intersecting planar quadrilaterals, which the artist defines with thin black lines. Interestingly, the process of linear delineation also produces the overall shape of the canvas, producing a sculptural sensibility to this particular series of artworks.

The tension between line and shape has always fascinated Mohr. His recent work phase explores both color and time, forcing the artist beyond the simple binary of black and white towards greater visual complexity and, through animation, showing the spatial relationships of line and form unfolding in real-time. Here the generative process is fully visible. Like *P511-N, Artificiata II* employs the diagonal path of a hypercube, the algorithm randomly choosing between eleven and thirteen dimensions (fig. 14). In this work, when the diagonal path changes direction it indicates the passage through a dimension. Horizontal lines are attached to the line at each change of dimension. The spaces between the horizontal lines of the diagonal path are filled with distinct sets of randomly chosen colors. By overlaying the color sets successively, "unpredictable constellations" of lines appear.[27] The color spaces and horizontal lines move within the structure as the diagonal path—the white line—moves in slow motion, rotating in the hyper-dimensional space.[28] Rather than producing one work, a flat two-dimensional image, the viewer sees the possible permutations within the algorithm unfold instantaneously. Autonomously, the animation could run continually, only repeating the same image in a cycle of every 100 years or so. Mohr is still surprised by the spatial ambiguities and linear configurations his algorithm generates, and for viewers, as they witness the line slowly moving within the architectonic space of the hypercube, they too sense the visual complexity of Mohr's system.

Digital Platonists and The Mythic Line

While Mohr's practice is defined by a rational and systematic approach to exploring the linear configuration of complex geometric structures, Jean-Pierre



[26] Alice Hattrick, Interview with Manfred Mohr, *The White Review,* online at www.thewhitereview.org, No. 5, Dec. 2012.
[27] Manfred Mohr, *Artist Statement, Artifiata II*, available from http://www.emohr.com.
[28] Ibid.

Hébert's practice is more fluid. Like an ancient geometer, Hébert delights in the way mathematical functions bend and shape geometric form. Whether it is differential, algebraic, or topologic geometry, Hébert has continually sought the arcane allure of the *harmonia* of Pythagoras, the ancient Greek philosopher who believed the world is beautiful because there is a certain measure, proportion, and harmony between all elements. The artist shares with the ancient philosopher the belief that geometry is the means to capture the often invisible, inner beauty of nature. While Hébert frequently uses Pythagorean premises, such as golden sections and Fibonacci numbers, the artist also employs

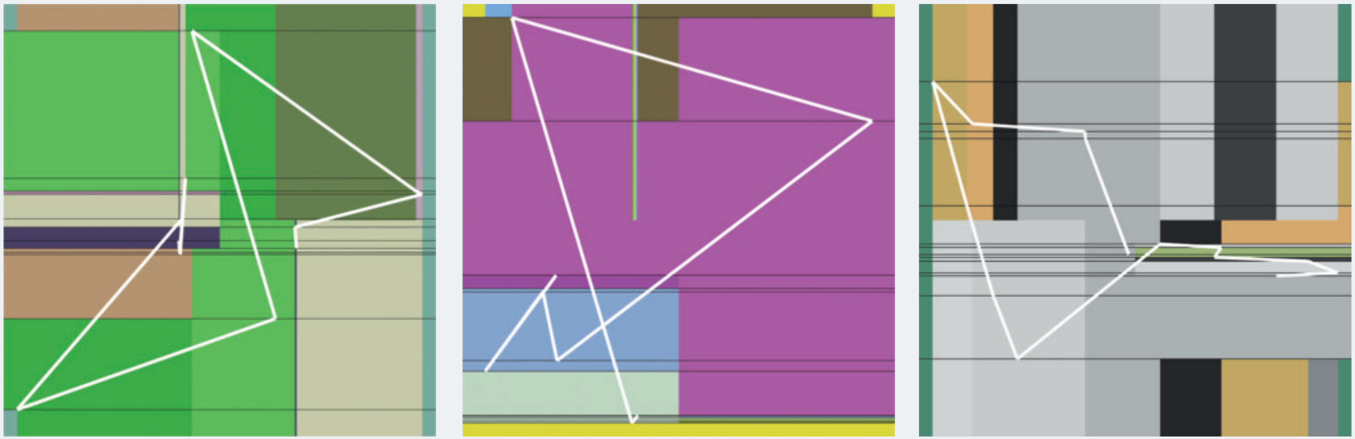


Figure 14
Manfred Mohr, three prints from Artificiata II - *P1612_67, P1612_70,* and *P1612_5220,* 2012, pigment ink on paper, 16 ½ x 16 ½ inches each, artist's collection.

a variety of new mathematical functions—periodicities, transformations, and asymmetries—to create a delicate, spatial equilibrium with line.

Hébert, a connoisseur of classical music, is the closest we have in the digital arts to a maestro. As an artist, he carefully shapes and unifies his various mathematical functions to create algorithms of incredible harmony. Born in Calais, France, Hébert had an artistic upbringing. Seeking refuge from the war and Nazi persecution, Hébert's mother took her son to live on his grandfather's estate in Vence, the medieval-walled village at the foothills of the French Alps. Vence had a rich artistic heritage, particularly for modern art. The town is commonly known for the Matisse Chapel (*Chapelle du Rosaire de Vence*), which was built and decorated by Matisse as a gift to the Dominican nuns who helped the artist recuperate after illness. Other masters made Vence their home, including Marc Chagall and Max Ernst. Picasso's Madoura pottery studio in Vallauris was nearby, and because the town was in the orbit of Picasso's playground, the French Riviera, Hébert saw Picasso on the beach. Many of the Modernists showed in the famed Galerie Chave, named after its founder Alphonse Chave, a figure who became prominent in Hébert's life. Pierre Chave, Alphonse's son, would hold Hébert's first solo show at the Chave Gallery in 1989. Entitled *Sans Lever La Plume* (Without Lifting the Pen), the exhibition showcased some of Hébert's most finely rendered computer-generated plotter drawings.

Hébert is undoubtedly the greatest exponent of the single, continuous plotted line drawing. Works like *Spirale calme* illustrate the power of Hébert's programming and subtlety, to which the artist was able to apply the unique capabilities of the computer-guided plotter (fig. 15). In the late 1980s, quite divorced from the computer art movement, Hébert embarked on some of the most exact and complicated single-line drawings ever completed. To generate this linear configuration

Figure 15
Jean-Pierre Hébert, *Spirale calme,* 1988, plotter drawing, sepia ink, 20 x 20 inches, Anne and Michael Spalter Digital Art Collection.

Figure 16
Roman Verostko, *Black Elk Speaks, Rocktown Scrolls,* 2006, pen and ink algorithmic drawing, 29 x 23 inches, Anne and Michael Spalter Digital Art Collection.

required years of painstaking work in which the artist, through trial and error, found the most suitable plotter, pens, and inks to support the process. Some of his larger, more complex works would take over 60 hours to plot, a mentally and physically exhausting period of time for the artist who remained without sleep. Any impurity in the ink could clog the pen, and the risk of a power outage was ever present. If a problem arose, the printer would fail, and because the design was reliant on the single, unending line, no retracing or starting from the same point was possible. If a technical failure occurred, three weeks of preparation would be for naught and the artist would need to start again. Like much of Hébert's art from this period, *Spirale calme* is made up of one finely rendered line that when viewed in total creates an intricate tapestry, a kind of translucent topology that mirrors the effect of light passing through a permeable membrane. The work has a fluid centrifugal force, as the line curls gently outward. This work shows the artist is not entirely subsumed by Western geometry, but is also moved by Eastern thought. The spiral, which appears in his Metagon Series and his kinetic sand installation, *Ryōan-ji*, possesses a Zen-like sensitivity, an equilibrium between two opposing forces. Through curvilinear forms, the artist is able to balance sensations of order and chaos, presence and absence. As the plotter became obsolete in the 1990s, Hébert found new capabilities with the ink-jet printers, which enabled him to make even smaller, more intricate lines, and allowed his moiré patterns to resonate and vibrate with added intensity. In his *Triptych: Bright Wavelets 1-3* the delicate structures reverberate, creating a linear membrane where shapes seem to surface only to recede (fig. 8). Unframed, the viewer is able to sense the texture and natural curvature of the fine, handmade paper,

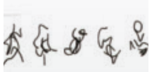
not unlike the vertical quality of a Chinese hanging scroll.

Like those ancient Platonists who viewed scientific explanation akin to mathematical proofs—as something one discovers rather than invents—the Algorists often view their art not as human constructs but rather as objects uncovered. Mathematical Platonism proclaims the belief in an archaic reality, a mathematical realm that exists independently of the human mind. If you are a Platonist in mathematics, Philip J. Davis and Rueben Hersh suggest you see yourself more as an "empirical scientist like a geologist, you do not invent anything, because it is all there already. All he can do is discover." [29] For Verostko, digital processes involve that mysterious and transcendental quality of discovery. Forms seem to emerge mysteriously and emanate from some extraneous source hidden in the depths of the machine. In Verostko's more recent "Cyberflower" series, the artist transforms his curvilinear line into a glyph, a type of coded character that stands for a letter of the alphabet. Each highly chromatic flower structure from the series has a coded quotation in the lower quadrant of the pictorial space. Like a tapestry suspended in animation, the flower floats above the text. *Black Elk Speaks, Rocktown Scrolls* (fig. 16) turns a poetic recollection from *Black Elk Speaks: The Life Story of a Holy Man of the Oglala Sioux* (1932) into a new linear alphabet, a type of enigmatic syntax. Verostko, like Hébert, titles his artwork after the suggestive qualities each design evokes, while Mohr and Wilson, in contrast, prefer a chronological numbering system that reflects their systematic, logical search for linear form.

Verostko is the most astute theorizer of the metaphysical element. In his seminal 1988 article, *Epigenetic Painting,* Verostko wrote enthusiastically that working with the computer was a world of endless discovery, for "each frontier opens a new frontier." [30] Importantly, Verostko built on the narratives of Platonic transcendentalism to provide a new mythology that characterized the computer as a portal into unknown, unseen, and unexplored worlds of digital abstraction. The computer was an infinite machine which gave access to a vast metaphysical frontier that was akin to what Verostko described as an "unfolding universe of visual form." [31] Verostko called his controlling algorithms, the program that generated much of his most important works, "Hodos," the Greek term for 'pathway.' Even before the conceptualization of "cyberspace" (the cybernetics metaphor of the "steersman" derived from the Greek term *kybernêtikê,* meaning 'the pilot'), the voyager or explorer was a central metaphor for Verostko.

[29] Philip J. Davis and Rueben Hersh, *The Mathematical Experience* (Boston: Birkhauser, 1980), 318.
[30] Roman Verostko, "Epigenetic Painting: Software as Genotype, a New Dimension of Art," *Leonardo* vol. 23, no. 1 (1990): 23.
[31] Roman Verostko, *Algorithmic Art: Composing the Score for Visual Art,* http://www.verostko.com/algorithm.html.





Through his extensive writings, Verostko explored the very limits of algorithmic representation, continually pushing his thinking toward the metaphysical dimension. Verostko is a type of mystic of the digital world—his works are a continual revelation. While Verostko, with his heightened sense of the spiritual, has the qualities of a mystic, he also has the attributes of a scholar, an individual desiring deep historical and theoretical understanding. He is at once a shaman connecting to the supernatural forces of the algorithm and a medieval monk working diligently in the scriptorium, endlessly honing his pigments, paper surfaces, and pen tips. His art reflects this duality. While it possesses various symbolic and esoteric meanings and embraces a visual otherworldliness, it is also highly logical and analytical. Verostko's life story is as complex as his art and serves as a key to understanding this dichotomy. Born in Tarrs, a coal mining region of Western Pennsylvania, Verostko first studied illustration at the Art Institute of Pittsburgh. After graduating, Verostko took up philosophy at St. Vincent College in Latrobe, Pennsylvania, before entering the seminary to study theology, eventually becoming a Benedictine monk. Before leaving monastic life, Verostko travelled and studied widely and completed monastic assignments that included writing on art and architecture for the *New Catholic Encyclopedia*. When Verostko eventually concentrated on a career as an artist, his accumulated knowledge and experiences inevitably informed his work.

Verostko remains a master of the plotted line. Like Hébert, Verostko is a highly skilled technician who engages the aesthetics of linear geometry at its highest level. But it is the many forms of symmetry and how these forms connect to larger universal forces that guide the artist. Verostko builds his complex spatial relationship by scaling, reflecting, and rotating his lines through various geometric transformations. In the left half of *The Manchester Illuminated Universal Turing Machine, version 18,* (fig. 17) the viewer can see the bilateral symmetry of self-similar lines building an intricate surface. Verostko's lines, which are sometimes ordered and other times chaotic, have a nebulizing quality, a life-force that seems to drive them. Under Verostko's direction, the plotter generates unique glazing effects and visual drift, which are formed by the physical overlapping of colored inks. The viewer can study at close range the linear complexity and shifting color fields it creates, or step back and grasp the overall symmetry of the form, an awareness spectators have described as sensing a deeper cosmic order. With the strange bilateral symmetry of the Rorschach test, the artist's composition seems to project onto the spectator's mind, inviting us to see something mysterious within this indefinable form. While Verostko's lines induce a feeling of the universal, it is in the binary code on the right half of the composition, the *recto* if we view it as open pages in a medieval manuscript, where we locate a unique form of universality. In the 5,495 binary digits—the 1s and 0s—we find recorded the most fundamental of all algorithms, the algorithm that underpins all digital reality—the Universal Turing Machine. First described by Alan Turing in 1937, the Turing Machine is a simple, yet brilliantly conceived mathematical abstraction intended to explain the extent and limitations of computation. Turing's basic procedural logic, a kind of meta-algorithm that governs all others, became the foundation of all digital operations. For Verostko, there was something supreme about Turing's algorithm; it was a text that spoke a true universal tongue, one

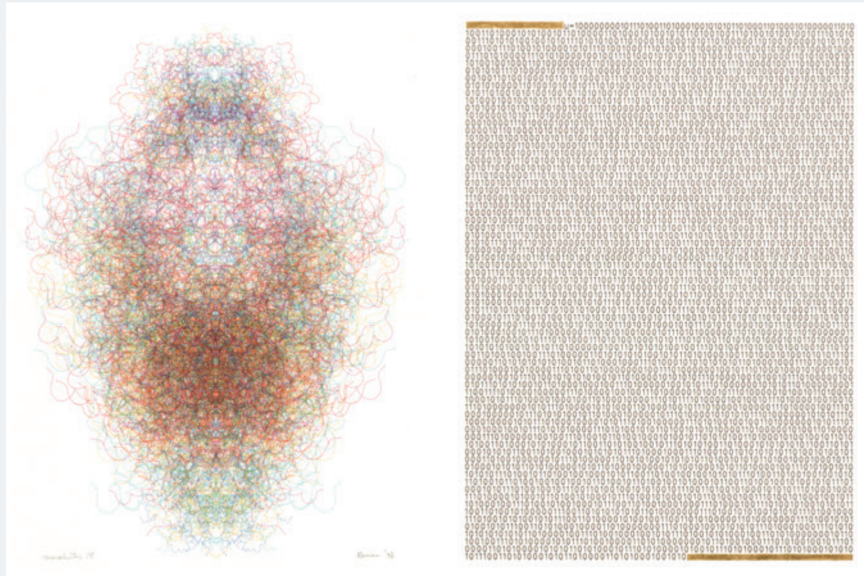
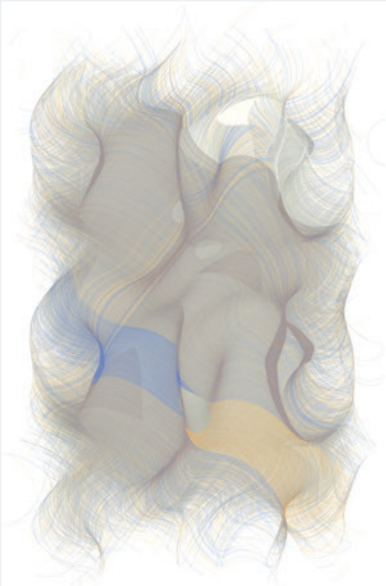


Figure 17
Roman Verostko, *The Manchester Illuminated Universal Turing Machine, version 18,* 1998, pen and ink with gold leaf enhancement, 22 x 30 inches, Anne and Michael Spalter Digital Art Collection.



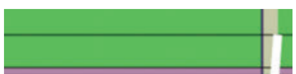
From the cover
Jean-Pierre Hébert, *Pillar of Infinitude, Fragment,* 2011, inkjet pigments on Niyodo paper, 22 x 17 inches, artist's collection.

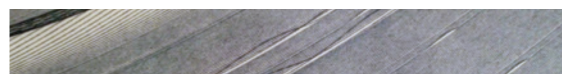
that appeared to transcend history. The artist pays homage to Turing by applying gold leaf to the page and giving his artwork the appearance of an illuminated manuscript, a codex with similarly cryptic and far-reaching codes.

Verostko's most unique contribution to digital mark-making is perhaps his plotted brush stroke. This breakthrough, a result of his highly experimental work with the pen plotter, came when the artist attached a Chinese brush to the machine's drawing arm and developed a sophisticated software routine to activate it. For the first time, the artist, who had studied the intricacies of Chinese and Japanese calligraphy, was able to achieve a stroke with a certain expressive energy, the dynamic form of the hand-drawn mark. Finally the cool rhetoric of the mechanical line with its exact precision gave way to a more organic, human sensibility. In his artwork *Nested Swallow,* Version I, Verostko simulates the expressionistic strokes of the human hand (fig. 9). The line has the temperament of a human creator, a line of pure energy and freedom. While we feel the flourish of the hand's action, a type of poetic vitality, we notice that the brushed line has a similarity to those lines beneath it. These smaller pen-drawn lines cluster at points in which the direction of the brush stroke shifts, showing that the brush work is in fact a vector moving through the defined points in Verostko's graphic space.

For all the Algorists, the algorithm is close to the surface, always exerting its generative force. And if we study the Algorists' art across the breadth of each career, the viewer is able to notice both subtle and substantial shifts in each algorithmic approach. A trail of works exists, a path in which artistic vision is rendered observable by the aesthetic decisions made in the face of infinite variation. Though these four artists now work independently of each other, their commitment to linearity and the algorithmic method continues to bind them. While the algorithmic approach is the same, each Algorist explores the line in new ways, bringing richness to our understanding of linearity. Whether it is the shimmering translucencies of Hébert's moiré patterns, the rigid orthogonality of Mohr's fractured cube, the boundless symmetries of Verostko's marks, or the geometric matrices of Wilson's layer forms, we witness the artists probing the limits of digital abstraction. While they are the pioneers—the first generation of artists to inhabit the exceedingly difficult world of computing—their careers are still evolving, a testament to the experimentalism they espouse. Moving beyond the plotter, the artists have shifted the paradigm of abstraction by exploring line generation in various media, including ink-jet and laser printing technologies, screen-based animation, video projections, kinetic installations, and analogue drawing devices. Such diversity is witnessed in this exhibition.

In the annals of art, the Algorists will be recorded as a uniquely original movement. As an astonishingly inventive group, a type of intellectual brotherhood, the Algorists appeared at a critical juncture in history when profound shifts were occurring in digital culture. In the history of digital art, their place has been carefully recorded and duly celebrated. Now it is time to place these trailblazing artists in the broader narrative of American art.





Exhibition Checklist

Jean-Pierre Hébert (b. 1939)

Self similarities, 1986
Plotter drawing, ink on paper
16 x 11 inches
Artist's Collection

Spirale calme, 1988
Plotter drawing, sepia ink
20 x 20 inches
Anne and Michael Spalter Digital Art Collection

Un cercle trop étroit, 1995
Plotter drawing, ink on paper
35 x 25 inches
Artist's Collection

Artist Book: Twenty-Four Views of the Metagon
1998
Twenty four iris prints
10 x 20 inches
Artist's Collection

Sand Installation: Ryōan-ji, 2000
Mixed media
4 x 4 x 1 1/2 feet
Private Collection

Triptych: Bright Wavelets 1-3, 2008
Inkjet drawing, pigments on Torinoko paper
3 panels, 77 x 38 inches each
Artist's Collection

Pillar of Infinitude, Fragment, 2011
Inkjet pigments on Niyodo paper
22 x 17 inches
Artist's Collection

Manfred Mohr (b. 1938)

Program 21, 1970
Plotter drawing
20 x 20 inches
Anne and Michael Spalter Digital Art Collection

P-197a, 1977
Plotter drawing
24 1/2 x 24 1/2 inches
Anne and Michael Spalter Digital Art Collection

P511-N, 1997
Computer calculated drawing on
acrylic/canvas/wood
40 3/16 x 66 15/16 inches
Artist's Collection

P1611_2, 2012
Pigment ink on canvas
35 1/2 x 35 1/2 inches
Artist's Collection

P1611_24, 2012
Pigment ink on canvas
35 1/2 x 35 1/2 inches
Artist's Collection

P1622-screen, 2012
NEC screen + Mac mini 2012
17 3/4 x 17 3/4 x 3 15/16 inches
Artist's Collection

A. Michael Noll (b. 1939)

Gaussian-Quadratic,
2003 copy of 1962-63 original
IBM 7090, Stromberg-Carlson S-C 4020
microfilm recorder
13 3/4 x 12 inches
Anne and Michael Spalter Digital Art Collection

Roman Verostko (b. 1929)

"Derivation of the Laws . . ."
by George Boole (1815-1864), 1990
Book (Edition #69)
6 1/8 x 10 3/16 inches
Anne and Michael Spalter Digital Art Collection

"Derivation of the Laws . . ."
by George Boole (1815-1864), 1990
Book (Edition #82)
6 1/8 x 10 3/16 inches
Anne and Michael Spalter Digital Art Collection

Scarab Series, 1991
Algorithmic pen & ink on tan Magnani paper
22 x 24 inches
Anne and Michael Spalter Digital Art Collection

Nested Swallow, Version I, 1997
Pen, ink and brush with gold leaf enhancement
42 x 30 inches
Anne and Michael Spalter Digital Art Collection

The Manchester Illuminated Universal Turing Machine, version 18, 1998
Pen and ink with gold leaf enhancement
22 x 30 inches
Anne and Michael Spalter Digital Art Collection

Black Elk Speaks, Rocktown Scrolls, 2006
Pen and ink algorithmic drawing
29 x 23 inches
Anne and Michael Spalter Digital Art Collection

Mark Wilson (b. 1943)

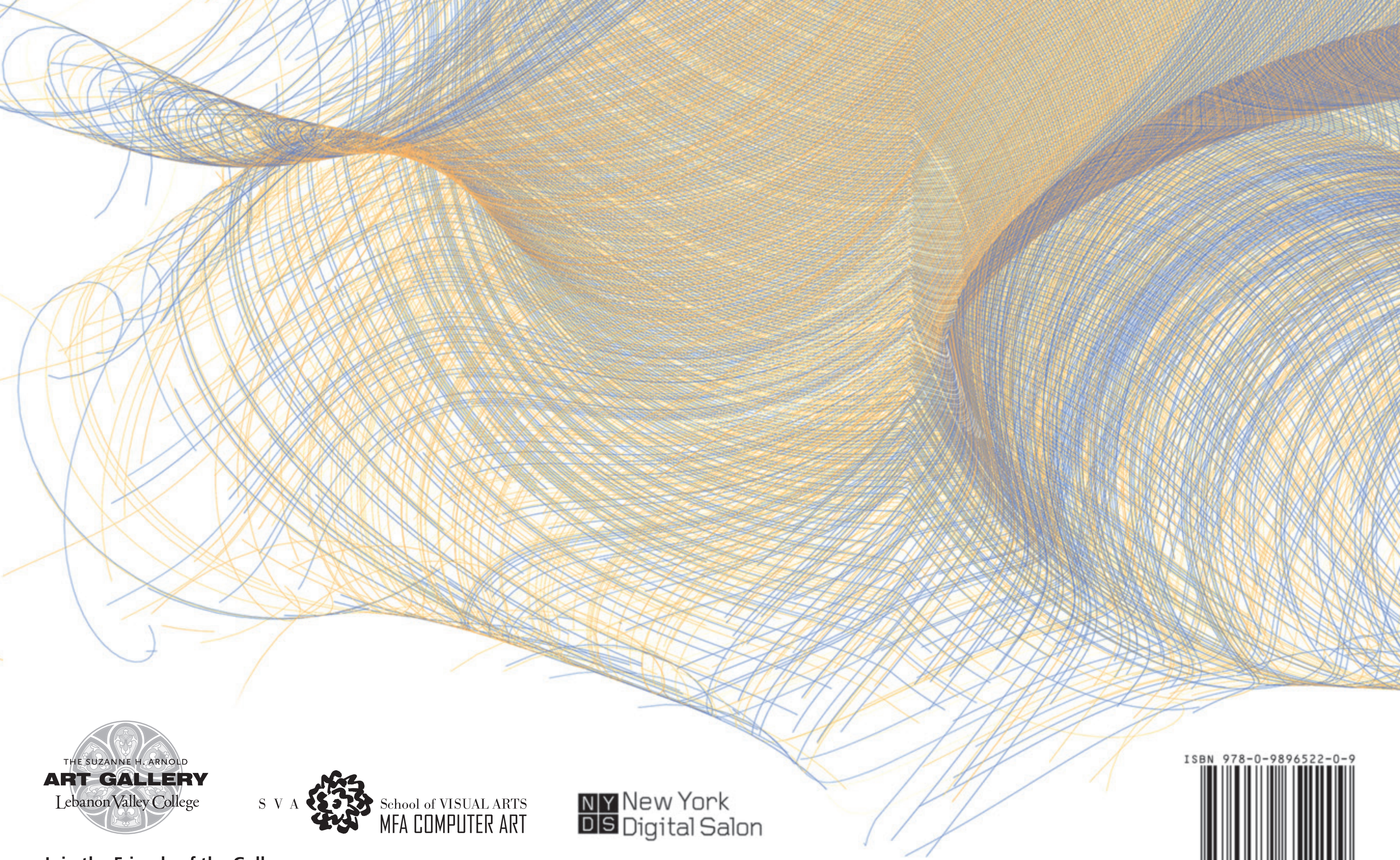
Douat Dump A2, 1981
Plotter drawing, ink on rag paper
12 x 12 inches
Artist's Collection

SKEW FF10, 1984
Plotter drawing
27 x 43 inches
Anne and Michael Spalter Digital Art Collection

PSC 32, 2003
Archival inkjet print
57 x 45 inches
Anne and Michael Spalter Digital Art Collection

csq3604, 2008
Archival inkjet print on rag paper
36 x 36 inches
Artist's Collection

e20808, 2011
Archival inkjet print on canvas
40 x 120 inches
Artist's Collection



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