The Howard Wise Gallery Show *Computer-Generated Pictures* (1965): A 50th-Anniversary Memoir

A. Michael Noll

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HISTORICAL PERSPECTIVE

The Howard Wise Gallery Show *Computer-Generated Pictures* (1965)

A 50th-Anniversary Memoir

A. MICHAEL NOLL

ABSTRACT

In April 1965, the Howard Wise Gallery in New York City held a show of computer-generated pictures by Bela Julesz and Michael Noll. This show was a very early public exhibit of digital art in the United States. This essay is a memoir of that show.

Bell Telephone Laboratories, Incorporated (nicknamed "Bell Labs"), was responsible for research and development for the Bell System and was owned jointly by the Western Electric Company and the American Telephone and Telegraph Company (AT&T). During the 1960s, pioneering research in digital computer art and animation was conducted at Bell Labs, along with research into stereoscopic vision. Bell Labs was a very creative facility, fostering research into computer music, art and animation. The graphics research, including its artistic application, was supported because of its potential application to communication between people and computers. From my perspective, this artistic application helped stimulate the development of new software that could also be used for scientific purposes.

Bela Julesz and I were employed as researchers at the Bell Labs facility in Murray Hill, NJ. Julesz had emigrated from Hungary in 1956 to join Bell Labs, where he investigated the psychophysics of stereoscopic depth perception using random-dot computer-generated stereograms. My formal assignments were the perceptual effects of telephone signal quality and the investigation of new methods to determine the pitch of human speech. However, I also realized the potential of digital computers as a new medium for the visual arts and created examples of such computer-generated artworks [1,2]. In 1965, Howard Wise exhibited our computer-generated pictures at his gallery in New York City. This memoir of that show was submitted to coincide with its 50th anniversary in 2015.

A. Michael Noll (retired educator, engineer, columnist), Annenberg School for Communication and Journalism at the University of Southern California, Los Angeles, CA 90089-0281, U.S.A. Email: <amnoll@yahoo.com>.

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THE HOWARD WISE GALLERY

Howard Wise was a wealthy industrialist, "noted for his interest in technology in art" [3], who was president of the Arco Company—an industrial paint and coatings company in Cleveland, Ohio [4]. He sold the business and then pursued his interest in art, having studied art at the Louvre and the Sorbonne in the 1920s [5]. In 1957, he started an art gallery in Cleveland, and a few years later he started a gallery in New York City.

The Howard Wise Gallery opened in 1960 at 50 West 57th Street in New York City and closed in 1970. Wise "foresaw the future of art to be an alliance between artistic and technological concerns, in which the machine was paramount" [6]. His son recalls that Wise "was a huge fan of technology when in business" and "it was during the mid sixties that he turned away from a focus on abstract expressionism toward the marriage of art and science" [7].

Wise developed a strong interest in kinetic and light sculpture. He also, however, foresaw the use of the digital computer "as a tool in the service of the artist" [8]. With his wealth, Wise became a patron and educator who did not have to run his galleries at a profit. In effect, Wise operated his gallery as something of a museum of contemporary art.

One of those artists whom Wise championed at his gallery was Gerry Oster. Oster was a biochemist and during the 1950s and 1960s was a professor of polymer science at the Polytechnic Institute of Brooklyn. He was an important figure in optical art ("op art") [9], which mostly involved abstract optical illusions. Oster's works were shown at the Howard Wise Gallery in early 1965 (4–27 February) in a show called *Oster's Magic Moires* [10].

THE HOWARD WISE GALLERY SHOW

Bela Julesz was using random-dot patterns generated by a computer in his investigations of stereoscopic depth perception. He discovered that "the recognition of shapes is not needed for the discrimination of textures or even, as had been thought, for the binocular perception of depth," as noted in the summary of an article by Julesz in the February

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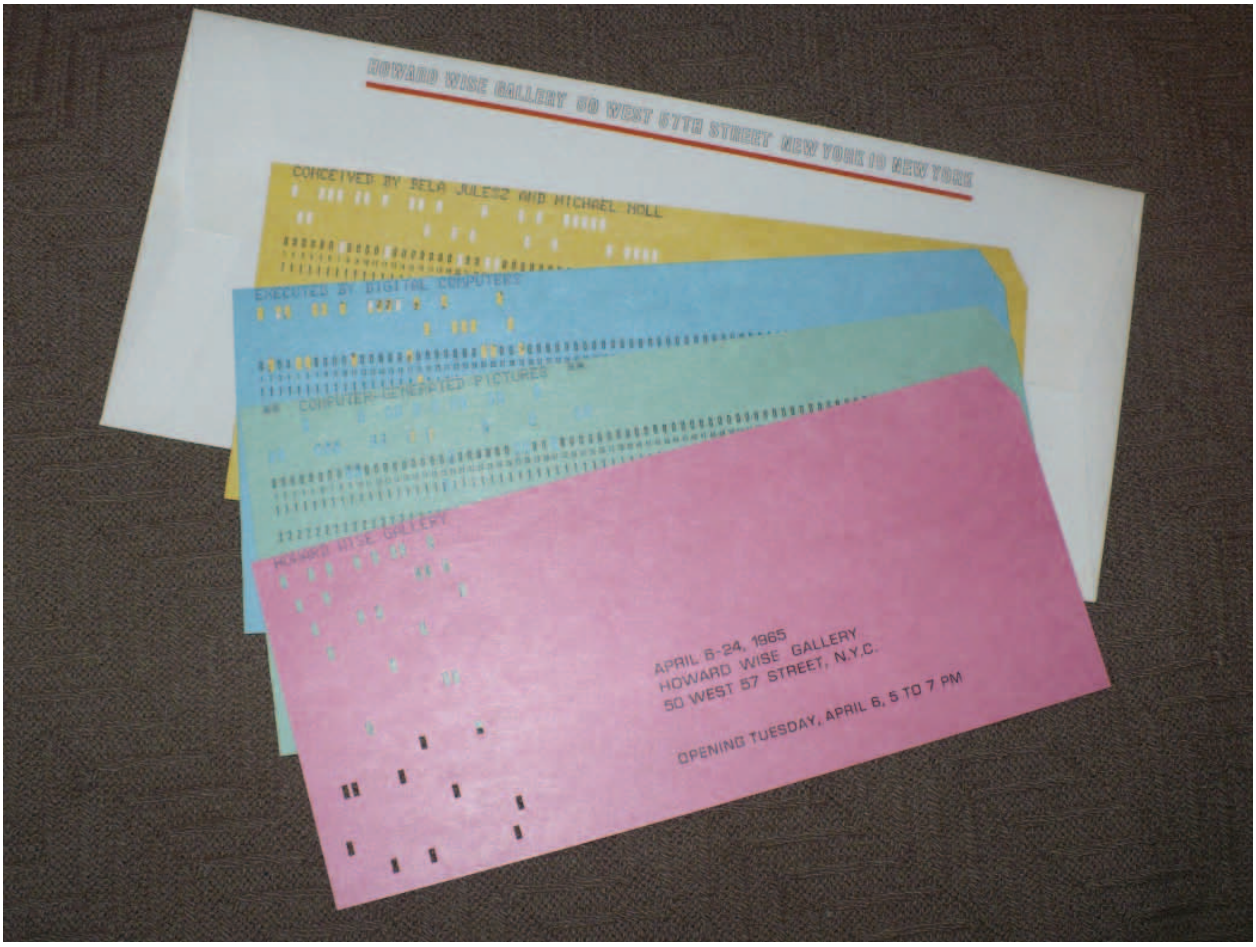

Fig. 1. A deck of four punched cards announced the Wise show. (Photograph courtesy of A. Michael Noll.)

1965 *Scientific American*; this publication of his research featured a color pattern by Julesz on the issue cover [11]. Wise saw this issue and contacted Julesz about exhibiting the patterns at the Howard Wise Gallery. Wise had space opening in April to accommodate the show. Julesz knew of my computer art and invited me to join him in the show. Wise, Julesz and I discussed our contract and its conditions thoroughly, finally agreeing that we would split equally the proceeds of any sale of any work after subtracting the costs of reproduction for the work. In the end, not a single work was sold.

The show, entitled *Computer-Generated Pictures,* was held 8–24 April 1965. The announcement for the show was a small deck of four punched cards in different colors, sent by post to the gallery's mailing list (Fig. 1). Figure 2 is a facsimile of the press release prepared by the Howard Wise Gallery to announce the show.

The originals of our works were mostly on 35-mm microfilm. Large prints had been made and mounted for the Wise show. A total of about eight two-dimensional works by Julesz and about 17 by me were exhibited, mounted on walls and partitions in the gallery (Figs 3–6). Wise was active in suggesting the size of the enlargements and how some could be mounted side by side in positive and negative enlargements. In addition to the enlarged prints, eight of our 3D stereographic works were displayed. The 3D works were each about 10 inches square, consisting of polarized left-eye and right-eye images mounted between sheets of Plexiglas. Polarized 3D glasses were available in a bin.

Stuart Preston reviewed the show in *The New York Times* and stated, "The wave of the future crashes significantly at the Howard Wise Gallery. . . . Freed from the tedium of technique and the mechanics of picture making, the artist will simply 'create.'" Preston also was struck by what he considered the "bleak, very geometrical patterns" and lamented a time to come when "the actual touch of the artist will no longer play any part in the making of a work of art" [12]. He did not realize that the artist would be involved as a programmer or algorithm creator.

Another reviewer in announcing the show summarized it negatively, as if it displayed the cutouts of IBM cards (although Wise believed the reviewer had not attended the show) [13]. Julesz was proud of his participation in this show and in 1995 wrote that he "took part in the very first 'computer art' exhibit (with another engineer colleague from Bell Labs, Mike Noll) in the Howard Wise Gallery in New York" [14].

I created a catalog of the works that were exhibited. A total of 10 numbered catalogs were created, each in a loose-leaf binder including photographic small prints of the works. Appendix A is a list of most of the works shown at the Howard Wise Gallery and reproduced as small prints in the catalogue [15]. My work *Ninety Parallel Sinusoids* was loosely based on Bridget Riley's op-art *Current* (1964). My work *Computer*

HOWARD WISE GALLERY 50 West 57th Street New York City 10019

PRESS RELEASE

CO 5-0465

COMPUTER-GENERATED PICTURES AT THE HOWARD WISE GALLERY

Tuesday, April 6, through Saturday, April 24, 1965

An exhibition of pictures conceived by two scientists, Bela Julesz and Michael Noll, and executed by IBM #7094 Digital Computer with the assistance of General Dynamics SC-4020 Microfilm Plotter, will be on view at the Howard Wise Gallery: opening April 6th.

Some of the pictures are in 2-D, others, when viewed stereoscopically through special glasses, supplied at the Gallery, are in 3-D. Some are in series, and give the illusion of viewing a sculpture from successive vantage points.

This exhibition demonstrates, to some small degree, the potentialities of the computer as a tool in the service of the artist. As computer technology progresses and costs come down, this technique will be more fully explored by the artist.

To produce a picture on a computer it is first necessary to formulate mathematically a means of determining an array of points, which when arranged in groups or connected by straight lines, will produce the desired pattern. Once these mathematical formulae have been obtained, they are punched onto standard IBM cards in the language understandable to the computer.

Following its "run", the computer records its output on magnetic tape. This information then instructs the microfilm printer to "draw" the finished pattern which appears on the face of a standard image orthicon tube. The pattern is photographed on 35 mm microfilm and the processed negative becomes the "original" picture. Prints are made by standard photographic techniques. This process also enables the originator to review the pattern, make any refinements he wishes and then run it again until a satisfactory result is obtained.

Presently, computer-generated pictures are limited solely by the state of the computer and microfilm art. Noll and Julesz see the day when a computer can draw - or paint - almost any kind of picture in any one or combination of colors.

Both scientists stress, however, that the artist need not fear being automated out of existence; rather, as they see it, the computer will free the artist for creation, unburdened by the tedium of the mechanics.

* * * * * *

Bela Julesz was born in Hungary in 1928. Graduated from the Technical University of Budapest and the Hungarian Academy of Science, he taught and did research in communications systems. He came to the United States in 1956, where he devotes full time to visual research, particularly in depth perception and pattern recognition. "Texture and Visual Perception" by Julesz appeared in the February 1965 issue of Scientific American, the cover of which carries an illustration in color of one of his experiments.

Michael Noll was born in 1939 in Newark, New Jersey. He received his education at the Newark College of Engineering and New York University, and is currently working towards his Ph.D. at Polytechnic Institute of Brooklyn, as well as carrying on his research work in the field of communications.

* * * * * *

Next exhibition: Three One-man Shows:
HERBERT BAYER – CHARLES HOWARD – CHARMION VON WIEGAND
April 27 – May 15
Hours: 10:00 a.m. to 5:30 p.m., Tuesday through Saturday

Fig. 2. Facsimile of the press release for the show *Computer-Generated Pictures* at the Howard Wise Gallery, 8–24 April 1965.

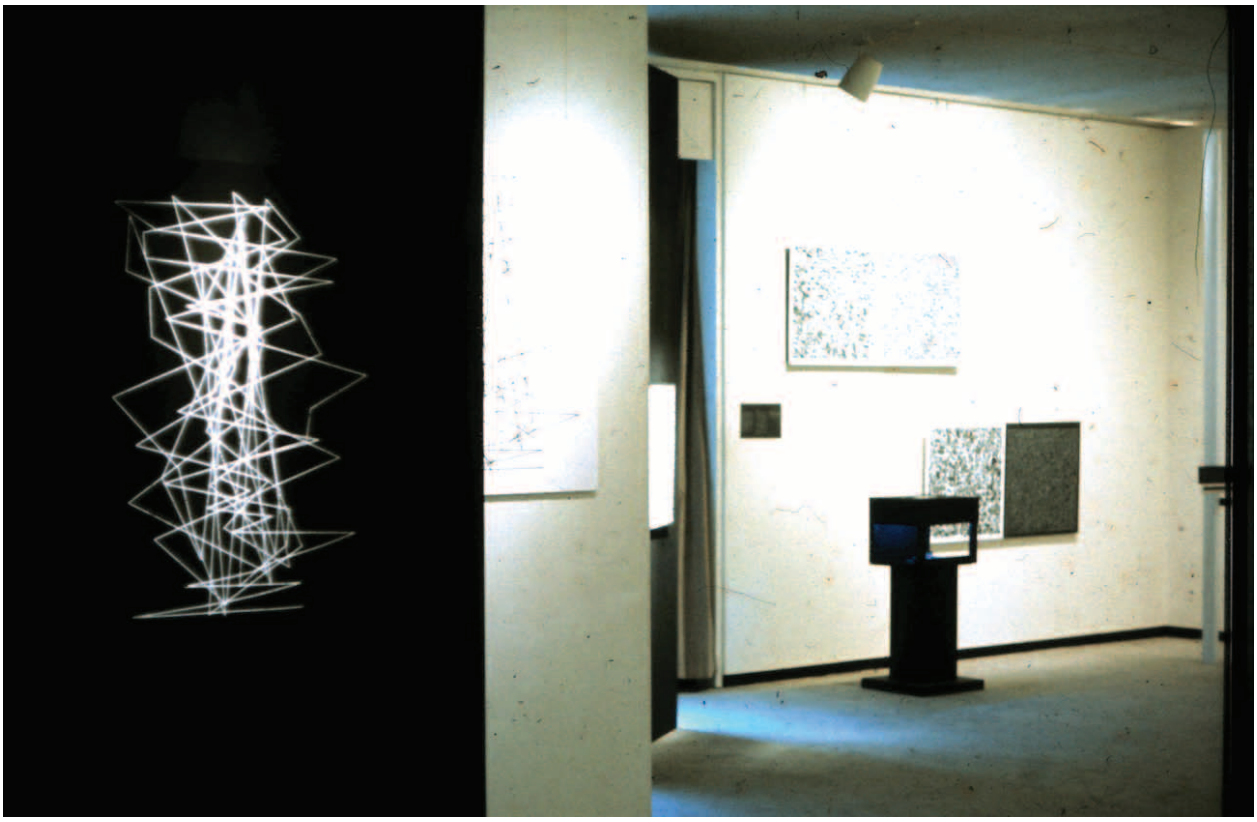

Fig. 3. *Gaussian-Quadratic* (© A. Michael Noll) is on the left, while two of Bela Julesz's pictures (© Thomas V. Papathomas) are on the far wall. (Photograph courtesy of A. Michael Noll)

Fig. 4. Stereoscopic transparent pictures by Michael Noll and Bela Julesz were suspended from a platform in front of the far wall. (Photograph courtesy of A. Michael Noll)

Fig. 5. The three panels in the foreground show a pattern by Bela Julesz on the left, six realizations of 2D stereographic projects of random vertical-horizontal structures, and parallel sinusoids. The works on the rear walls are from another show. (Photograph courtesy of A. Michael Noll)

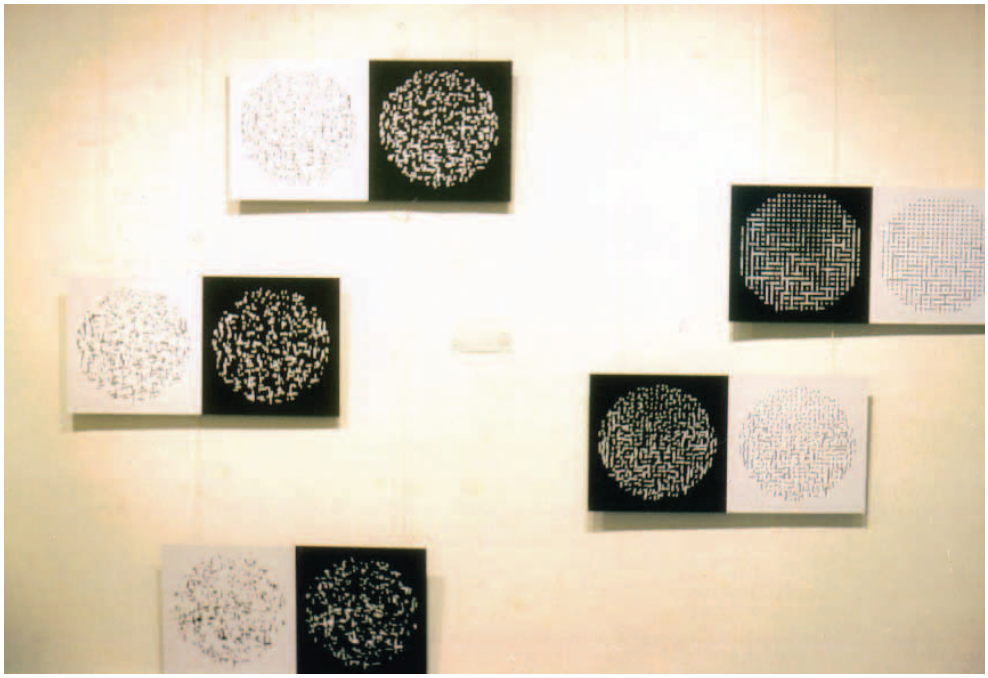

Fig. 6. Five variations on Noll's *Computer Composition With Lines* with positive and negative pictures mounted together. (© 1965 A. Michael Noll)

Composition With Lines was based on Piet Mondrian's *Composition With Lines* (1917).

The public relations people at Bell Labs were enthusiastic about the show. However, AT&T was not and tried to stop the show. AT&T was concerned that local regulators would see the creation of art at Bell Labs as a superfluous waste of telephone charges by the monopoly. Wise threatened to sue, as he had already scheduled and announced the show. Julesz and I were told by AT&T to avoid mentioning Bell Labs and to limit any publicity. We were told to copyright all the works in our own names to that end. Accordingly, Julesz and I signed the front of each work with a copyright symbol and our initials and the year 1965 on the back. The copyright date was the year the work was first displayed and offered for sale: namely, 1965. However, many of the works had been created a few years earlier. It is relevant that neither Bell Labs nor AT&T had any interest in making money from computer art and animation.

AFTER THE WISE SHOW

After the show, my works were returned to me at Bell Labs. Later in the year, some of them were shipped to Las Vegas to be exhibited at the Fall Joint Computer Conference. I eventually gave away all the works to colleagues at Bell Labs, who hung them in their offices. One colleague, George Sperling, acquired a very large photographic print of *Computer Composition With Lines* for his apartment in New York City.

A year or so after the Wise show, I learned that Georg Nees and Frieder Nake had also exhibited digital computer art in Germany in 1965. Works by Nees were presented in February 1965 at the Technische Hochschule Stuttgart, and Nees and Nake exhibited together in November 1965 at the bookshop of Galerie Wendelin Niedlich in Stuttgart [16].

In addition to the digital computer art that I created at Bell Labs, there was also research being done there in computer animation and computer music [17]. All this work at Bell Labs during the 1960s in music, art and animation helped lead the way to what today is known as multimedia and new media [18]. Back in the mid-1960s, however, the digital computer did not have the acceptance and availability that exists today—nor was it accepted as a tool or medium for the arts [19].

Appendix B includes commentaries about the impact of Howard Wise and this show. In his commentary, Roman Verostko acknowledges the influence that the show had on his algorithmic art. Nam June Paik also saw the show and had "great interest" [20].

APPENDIX A: CATALOGUE LIST

***Gaussian Quadratic*—1963**

Michael Noll

The horizontal positions of the end points of the line segments have a Gaussian random distribution while the vertical positions increase quadratically. The result is a line that starts at the bottom randomly zig-zagging its way to the top in ever-increasing steps. When the line reaches the top, it is reflected back to the bottom to once again continue its rise.

***Labyrinth*—1960**

Bela Julesz

An array of ten-thousand equally probable randomly selected black and white squares with diagonal connections broken.

***Vertical-Horizontal Number Three*—1964**

Michael Noll

One-hundred-and-one randomly selected points were connected by vertical and horizontal line segments to form a single line.

***Similarity*—1964**

Bela Julesz

Left and right pictures have 80% of their picture elements identical. Whenever three adjacent picture elements are all black or all white along the diagonals in the left picture the middle point is complemented (white changed to black and vice versa) in the right picture. The two pictures are identical enough to fuse binocularly when viewed in a stereoscope. Nevertheless, the removal of diagonal connectivity makes the two pictures very distinct when viewed separately.

***Study of Contours*—1963**

Bela Julesz

Left picture consists of equally probable random black and white squares. Right picture is derived from left picture by taking the outlines at the boundaries of black and white clusters.

***Computer Composition With Lines*—1964**

Michael Noll

The position of the vertical and horizontal bars has been chosen at random with the constraint that the position must fall inside a circle. The length and width of the bars was chosen at random within a specified range. If the position of a bar fell within a parabolic region in the upper half of the circle, the length of the bar was shortened by a factor proportional to the distance of the position from the edge of the parabolic region. The motivation for this type of pattern came from Piet Mondrian's *Composition With Lines* (1917).

***Variations on Computer Composition With Lines*—1965**

Michael Noll

This series of variations reproduced with positive and negative side-by-side, shows the effect of increasing the randomness of the positions of the vertical and horizontal bars. The picture is conceptually divided by crossing vertical and horizontal lines and a single vertical or horizontal bar is placed at each intersection of these imaginary lines. However,

provisions are available for moving the bar a random distance from the intersections. Increasing the amount of randomness from zero produced the "Variations."

***Kaleidoscope*—1962**

Bela Julesz

Random-dot patterns with horizontal and vertical symmetry axes. The mirror image is generated by the computer.

***Quasi-Kaleidoscope*—1962**

Bela Julesz

Horizontal and vertical symmetry in the neighborhood of the symmetry axes removed by adding random dots.

***Six Realizations*—1965**

Michael Noll

The six individual realizations are computer-generated two-dimensional projections of random computer-generated three-dimensional structures. Each structure is composed of a total of eighty-five vertical and horizontal line segments. Although the six realizations are statistically identical, a different set of random numbers was used for each realization.

***Ninety Parallel Sinusoids with Linearly-Increasing Period*—1964**

Michael Noll

This picture was produced by mathematically specifying the top line as a sinusoid with linearly-increasing period. The computer then repeated this line ninety times. In this manner, the computer is used to eliminate the tedium in generating pictures that consist of a basic motive that is repeated a number of times throughout the picture. Since the computer "draws" only connected line segments, the lines appear wavy. Better resolutions and associated technological improvements would eliminate this problem and would also allow width modulation of the lines.

APPENDIX B: COMMENTARIES ABOUT HOWARD WISE GALLERY

Howard Wise was an enormously influential figure in the development of video art and the origins of digital media art in the 1970s and 1980s. At a time when video was still emerging, and was a medium for a lot of experimentation, Wise was one of the few patrons of the medium. He retired from a career as a successful businessman and opened the Howard Wise Gallery in New York in 1960. He went on to hold a number of highly influential exhibitions, including early exhibitions on kinetic art, light sculpture, and art and technology, and then, most famously, the *TV as a Creative Medium* show in 1969. With important early works by Nam June Paik and Charlotte Moorman, Frank Gillette and Ira Schneider, Aldo Tambellini, Eric Siegel, Paul Ryan, and others, *TV as a Creative Medium* is a now legendary exhibition in the origins of video as a creative medium, precisely because it was one of the first times that these works were brought together. Stories of people being inspired by the show proliferate. Wise's gallery was both foresighted and idiosyncratic, and his genuine fascination with new art forms and disregard for the art world system made him a kind of accidental avant-gardist and visionary. Wise closed the gallery in 1970 and went on to found Electronic Arts Intermix, which is still operating as an important distributor of electronic art. His legacy remains enormous, and can be seen in the wide range of artwork today that explores electronic and digital media forms.

MARITA STURKEN, PROFESSOR,
DEPARTMENT OF MEDIA, CULTURE, AND COMMUNICATION,
NEW YORK UNIVERSITY

In the 1960s the Howard Wise Gallery seduced us with marvelous shows of "op" and "light" art. My memories include showings of Gerald Oster's Moirés, Dan Flavin's mysterious light installations, and the provocative work of the Group Zero. The 1965 "Computer-Generated Pictures" was decidedly different by showing us visualizations achieved with coded instructions. Michael Noll's work, based on Mondrian's compositions, stands out in my mind as the work that helped shape my approach to algorithmic art some years later.

My pre-algorithmic work included constructivist elements influenced by the theory and practice of Piet Mondrian. I was especially drawn to the "dynamic equilibrium" Mondrian sought in the placement of vertical and horizontal visual forms. My "New City" paintings of the 1960s included a similar visual quest [21]. Noll's "Computer Composition With Lines" led me to see that one could code concepts for form-generating visual ideas. Those who learned to write the code (the "score") for their own form-generating ideas would have access to new visual frontiers. Just as musicians could compose a score for their musical ideas artists could now, with computing power, compose the score for their visual ideas [22]. Looking back 50 years we can thank Howard Wise and the Bell Lab researchers for pointing the way.

ROMAN VEROSTKO, ARTIST, MINNEAPOLIS, MN

As an artist and educator who teaches digital art and new media, I have researched the development of computer art, and the show at the Howard Wise Gallery in 1965 stands out as a critical milestone. Not only is it one of

the first exhibitions of computer art, it also is seminal in its approach to computer work as fine art, directly situating it in the history of graphic creation in the arts. This show and the works shown there have been an influence on my motivation to create digital art and on the development of my work. Although it took several years to gain access to a computer system, by 1978 I was teaching myself programming and working toward my first exhibits. Since then I have continued to create digital work, focusing on physical installations and digital environments.

PHILIP F. SANDERS, ASSOCIATE PROFESSOR,
FOUNDER OF INTERACTIVE MULTIMEDIA DEPARTMENT,
THE COLLEGE OF NEW JERSEY

References

1 Noll, A. Michael, "Computers and the Visual Arts," *Design and Planning 2: Computers in Design and Communication* (Edited by Martin Krampen and Peter Seitz), Hastings House, Publishers, Inc.: New York (1967), pp. 65–79.

2 Noll, A. Michael, "The Digital Computer as a Creative Medium," *IEEE Spectrum*, Vol. 4, No. 10, (October 1967), pp. 89–95.

3 Gaines, Catherine S., "A Finding Aid to the Howard Wise Gallery Records, 1943–1969, in the Archives of American Art," Smithsonian Archives of American Art, 2006, n.p.

4 Howard Wise Gallery Records, Smithsonian Institution.

5 Sturken, Marita, "TV as a Creative Medium: Howard Wise and Video Art," *Afterimage*, May 1984 (posted at the Experimental Television Center website).

6 Press Release, Moeller New York + Berlin, "Howard Wise Gallery: Exploring the New," April 27–July 13, 2012.

7 Personal email from Daniel Wise dated August 26, 2014.

8 Howard Wise Gallery Press Release, "Computer-Generated Pictures," CO-5-0465 (April 1965).

9 Oster, G., "Optical Art," *Applied Optics*, Vol. 4 (1965), pp. 1359–1369.

10 Jonas, Gerald, The Talk of the Town, "Op (Cont.)," *The New Yorker*, February 27, 1965, p. 24.

11 Julesz, Bela, "Texture and Visual Perception," *Scientific American*, Vol. 212, No. 2 (February 1965), pp. 38–48.

12 Preston, Stuart, "Art ex Machina," *The New York Times*, Sunday, April 18, 1965, p. X23.

13 *TIME*, April 23, 1965, pp. NY5-NY6.

14 Julesz, Bela, *Dialogues on Perception*, MIT Press, 1995, p. 96.

15 An original of the catalogue of works from the show is in the permanent collection of the Los Angeles County Museum of Art.

16 Email dated June 12, 2014 from historian Margit Rosen.

17 Noll, A. Michael, "Bell Telephone Laboratories, Incorporated: An Early Digital Media Lab," June 8, 2014, <http://olats.org/pionniers/memoirs/noll/BellTelephone.php>.

18 Art & Science Collaborations, Inc., organized a panel in 1998 to discuss "Bell Labs & the Origins of the Multimedia Artist." A video and transcript are at: <www.ieeeghn.org/wiki/index.php/Archives:Bell_Labs_%26_The_Origins_of_the_Multimedia_Artist>.

19 Taylor, Grant D., *When the Machine Made Art: The Troubled History of Computer Art*, Bloomsbury (New York), 2014.

20 In a letter to Noll dated November 30, 1966, Nam June Paik wrote: "I have been following your work with great interest since the Howard Wise show in 1965." Paik soon after visited Bell Labs "to survey the possibilities there."

21 The New City Paintings: <www.verostko.com/history/sv/studio 63-68.html>

22 Software as Genotype: <www.verostko.com/archive/writings/epigen-art-revisited.html>.

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A. MICHAEL NOLL *is Professor Emeritus of Communications at the Annenberg School for Communication and Journalism at the University of Southern California. Noll's varied career includes basic research at Bell Labs, science policy on the staff of the White House Science Advisor and marketing at AT&T. A pioneer in computer art, stereoscopic computer animation and force-feedback (a forerunner of today's virtual reality), Noll has published nearly 100 research papers, 11 books related to telecommunication technology and communications, and over 150 opinion pieces and columns for newspapers and trade publications. His current research, primarily archival and historical, focuses on Bell Labs and digital media.*