From Noise-to-Signal: Early Explorations in Digital Photography (1986-1990)

George Legrady

INTRODUCTION

From the fall of 1986 until 1990, I realized a series of digitally-created, inkjet works-on-paper that may be one of the first generation high-resolution, pixel-based photographic digital images printed directly from digital data of images produced on an IBM AT computer equipped with the AT&T Truevision analog-to-digital video capture board and custom software. Images were first captured through an analog video source, either from a video camera or from television news, then processed through custom image-processing software or generated purely from code in C language.

Ideas and themes explored in these images were informed by discourse from the field of semiotics pertaining to the analyses of the image as explored by Barthes and Baudrillard's simulacra, systems and processes inspired by artworks from the conceptual art movement, all of which were then fused with aspects of Claude Shannon's Information Theory which offered definitions of communication such as entropy, redundancy, signal as ordered information and noise as random information. Given that video was the only source by which to capture camera-images, much of the visual themes in these works, also focused on an exploration of the visual staging of images captured from television broadcast news. These resulted in a series of 57 distinct compositions, and approximately 98 actual inkjet prints, possibly the first such digital photographic-based works transferred digitally from software in which the images were directly transferred to a prototype printer, the Fuji Jetgraphix system, at a lab near UCLA. This paper describes the evolution of these works, and the transitioning and integration of computer processing in my photographic and artistic practice in the mid to late 1980s.



George Legrady, Santa Fe Art Colony Studio, Los Angeles, 1988

BACKGROUND

I had acquired computer-programming skills in the fall of 1981 in the studio of the painter Harold Cohen, a professor in the Visual Arts Department at UCSD. Harold was developing an artificial intelligence-based software titled "Aaron" that produced painterly images, guided by complex aesthetic rules that Harold had translated into code according to studies of how he, as an abstract painter, made creative decisions in the painting process. Harold generously gave me access to his studio for a period of 3 years, until my move to Los Angeles in 1984. The system in the studio, a PDP-11 and eventually, a VAX both by DEC Corporation, were producing their visual output on a vector-based, phosphorous Tektronix 4010 screen, drawing lines by a green electronic beam. For his museum exhibitions (Tate, SFMOMA, Stedelijk, etc.), Harold had designed custom pen plotters on wheels that sent sonar signals picked up by microphones placed at each corner of a large paper on the floor on which the plotters were drawing as a way to keep track of the location of the plotters.

At that time, my artistic work was in large-format, studio photography of subject matter that explored the semiotics of the photographic image, driven by conceptual questions to explore the grammar of the photographic image. This approach in the 1980s fit into an aesthetic direction described as "staged photography". While learning programming in Harold's studio, I held a visiting faculty position in Photography from 1982 to 1984 at Cal Arts, and in 1984, became an assistant professor in photography in the School of Fine Arts at USC where I remained until 1988. While at USC I began to look into possibilities in merging my interests in a conceptual approach to photography and the integration of computational processing. Fueling the planning and thinking of how to proceed, I was fortunate to meet two inspiring individuals in the Annenberg School of Communication at USC, social scientist Daniel Dayan, a student of Roland Barthes, was a communications and semiotics specialist and the engineer, pioneer computer artist A. Michael Noll, formerly a Bell Labs researcher, had recently arrived on campus.

The possibility of digitally capturing a photographic image became a reality around 1985 with the release of the AT&T Truevision TARGA raster graphics image capture videoboard added inside a desktop IBM personal computer AT. The Targa system made it possible to digitize high-resolution, pixel-based images at 16 bit or 32768 colors by connecting to an analog video source such as a video camera or any television signal and the Targa would capture and translate the signal to a digital pixel-based image. My exploration of this system began in 1986 when I was able to acquire a few workstations in 1986 through funding support from IBM's "Project Socrates" academic donation program, and USC's Innovative Research, and Innovative Teaching awards.

Subject Matter & Themes

Once I connected the system to a video source, I was surprised to find a continuous stream of noise coming to the screen, a random visual stream that became of visual and conceptual interest. Without internet or community, I was at a loss as to how to proceed and how to contextualize the explorations I was to engage in. By some circumstance, I came across Claud Shannon's groundbreaking Information Theory, which provided the mathematical means to study the relationship of signal to noise at Bell Labs in the late 1940s.



Close-up of a digital capture of a stream of analog TV noise, 1986

The subject matter for the creation on this system was limited to images coming through analog video capture from television or a video camera. From the video stream, still frames could be captured, and the Truevision analog-to-digital converted the images into raster, pixel-based files. Once digitized the images could be manipulated and processed at the pixel level through software I would write in C programming language.

The process of dissecting the pixel relationships and reconfiguring them through software became a key exploration, essentially influenced by Claude Shannon's various concepts deriving from "Information Theory", in specific the relation between noise and signal, each being communication but one meaningful, the other unplanned. Various semiotic texts such as Roland Barthes's "Rhetoric of the Image" in Image-Music-Text were inspirational in how to semantically explore the digital image as a linguistic structure, given that it consisted of pixels ordered symmetrically within a 2D matrix, and that each pixel consisted of specific numerical values, such as horizontal and vertical locations and color values. Once extracted, they could then be mathematically evaluated and changed based on how each pixel's values related to its surrounding pixels.

As TV was the only visual source, I became intrigued by the visual and semiotic staging of TV news in particular at ABC News, for instance in the ways the newscasters were placed, the pattern backgrounds behind them, the textual labeling of news footage, the look of how small windows with news events were placed with shadow backgrounds. Because of the limitation of capturing images through video, the visual staging of television news became an ideal subject to explore semiotically, and the ray-tracing used to reflect digital photographs onto virtually constructed frames fit perfectly with Baudrillard's definition of simulation, the imitation of the real through the virtual.

My first exhibition of these "digitally direct from-data-to-paper" images took place at the USC Atelier, an off-campus outreach fine arts gallery, an off-campus extension of the University of Southern California located at the Santa Monica Shopping Center. For my exhibition titled "From Noise to Signal" from July 7, 1987 to August 31, 1987, I presented my first Fuji inkjet works-on-paper and staged the gallery to look like a computer production office, as the space in the mall, located on the top floor, could have been previously occupied as an office. I brought my computer equipment to the gallery and worked in the gallery on various days throughout the exhibition. In this way, the public could view the exhibited images and also witness the image creation process of how digitally captured and processed images evolved, and additionally how such a computer system worked¹.

¹ George Legrady Will be Minding The Store, by Zan Dubin, July 5, 1987, described in the Los Angeles Times the exploratory process of creating onsite digital imaging artwork in real-time. http://articles.latimes.com/1987-07-05/entertainment/ca-2234_1_george-legrady



From Noise to Signal, Exhibition Announcement, USC Atelier Gallery, Santa Monica Place, July 7 to August 30, 1987



Authority of the News (1987), Fuji jetgraphix prints. Collection Santa Barbara Museum of Art (2017)

This series of works-on-paper were created between 1986 and 1990 on a state-of-the-art IBM AT computer (8MB RAM) acquired in 1985 funded by an IBM Socrates grant and research awards at the University of Southern California in Los Angeles. The AT&T Truevision TARGA analog-to-digital raster videocard placed inside the IBM was released in 1985 as the first IBM PC compatible graphics card to support 16 bit (32658 colors) high-resolution color with a 512 x 512 pixel image size. The TARGA board made it possible to capture and digitize video image sources, to manipulate the image through C language, and to output to the TARGA file format. It required an additional separate video display monitor to view the range of colors. A key component of the TARGA format was that it had an alpha channel for pixel transparency, allowing for manipulation of non-rectangular pixel groupings as in the "Words/Words" series below. At the time of its release, the TARGA file format was the state-of-the-art for digital image processing. Over the five-year period, I created between 50 to 60 images and approximately 98 prints were digitally output to a unique prototype high-resolution inkjet printer made by Fuji located at UCLA.

This early work with digital photography followed a decade of large-format studio work in constructed photography informed by "staged photography" practice where one built up the composition similar to constructing a stage set. I came to this approach with a strong interest in visual semiotics as the intent of the images was to explore propositions based on deductive reasoning, to establish to what degree can a photograph verify visually what it is intended to show. The focus later shifted to the constructing of visual narrative tableaux, resulting in a solo exhibition at Projects Studios One, room 202 in 1981. The transition to digital photography with the Targa system took some figuring out as resources, references, knowledge, skills, community and opportunities did not yet exist. This was 5 to 10 years prior to the availability of digital cameras, image-processing software such as Photoshop, and the internet. The discovery of the manipulative possibilities of the discreet pixel-image through programming led me to Claude Shannon's Information Theory, in specific to the definitions of signal-to-noise and redundancy.



"LiveX" (1989) composite digital image composition, 512x418 pixels. "LiveX" is made up of three separate components. The background texture consists of the word "Live" digitally captured from TV news, and then randomly spread across the image to result in an aesthetic texture, an accentuation of the function of text labeling on images, as according to Barthes, the label becomes the most critical element defining and limiting the meaning of the image. The image frame in the center was created in Wavefront Technologies, given a metallic reflected surface, and using ray-tracing software to simulate reflection of a news screen capture of a political demonstration in East Europe, at the time of the breakdown of the Berlin Wall, and the end of Communism. This event has been of particular interest to me as I was a political refugee from East Europe during the Cold War and the raytracing may be an apt example of Baudrillard's simulacra. The center noisy, abstract texture is the actual image of the demonstration but scrambled through custom-software I wrote. Shannon's Information Theory was a core influence in my approach to understand the pixel-based, digital image which consist of a sequence of pixels with color values in a grid. Given that a digital photograph is a sampling of a visual scene recorded on sensors that captures photons directed to it through a lens, every pixel's color value is dependent on its neighbor's. This relationship can be mathematically manipulated, and reshuffled from recognizable to undecipherable and then back to being recognized, a method directly stemming from Shannon's definitions of signal-to-noise.

RELATED WORKS



Words/Words (1987) "News Beirut", "Hanoi" and "Manila". 3 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm) Each image consists of visual fragments from a news screen digital capture, where the text label describing the visual scene has been irregularly cut and then randomly spread across the full image, transforming the label into the visual composition itself, suggestive of the semiotician Roland Barthes' identification of text functioning as "anchorage" defining the meaning of the image.

Exhibitions: *Photography of Invention* (1988), National Museum of American Art, Smithsonian, Washington, an exhibition dedicated to constructed photographs that were made rather then taken. Other artists include Barbara Kruger, Louise Lawler, Sherrie Levine, Cindy Sherman, etc.; *"Fotografie, Wissenshaft und Neue Medien"*, Kunstforum, Düsseldorf (1988); National Gallery of Canada (1997). "News Beirut", received an honorable mention at Ars Electronica (1988) and "Manila" is in the collection of the Canada Council Art Bank in 1990



Poetics of the News (1988) 4 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm) each. Each of the four images feature different background text patterns, commentaries on the state of the news. "Lost like Tears in the Rain", from the movie "Blade Runner"; "A Shadow of its Former Self"; "The Space Between"; "A Sea of Noise". The flickering flame is from a news story on the homeless warming themselves standing near a fire in an oil drum. The fire sequence is a visual metaphor inspired by the use of "eternal flames" for fallen soldiers in Socialist monuments.

Exhibitions: "George Legrady: From Analogue to Digital", National Gallery of Canada, Canadian Museum of Contemporary Photography (1997-1998).



Beneath the Surface, Scratching the Surface (1988) 2 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm) each. Left image background texture built up using custom software based on Brownian motion followed by 2D convolution for blurring to create depth. Right image also uses Brownian motion process but with color sample values from an external image of a rusty surface. Both image have the same ray-tracing, reflective frames, with scrambled images inside.



Template, Red Background (1988) 2 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm) each. Left image is a news reporter whose face is blanked out to match the background.



NewsTalk, ContraGate (1988) 2 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm) each. Left image background is of burning tires. Right image background is of the Iran Contragate weapons and cocaine cover-up.



Street Scene: Police, Street Scene: 2 women on Sunset blvd (1989) 2 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm) each. Both images are processed with a smudging software to transition the image from signal to noise. Each image has a vertical slice of the original prior to the smudging for comparison purposes.



Girl/Tiger, 87% Value Free; NeedleX, 64% Value Free; Handcuffed; Crashed car (1989) 4 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm). Following Shannon's definition of redundancy in language, custom software turns unnecessary pixels to black.



The Noise Factor: Film Still, Pure Noise, Coke & Stocks; Conversation (1987) 4 inkjet images, digitally transferred and printed on Fuji Jetgraphix system. 23 5/8 x 28 5/8 in. (60 x 72.7 cm). Various processes based on Shannon's definition of signal as ordered information and noise as random information. "Conversation" is in the LACMA Vernon Photography collection.

Conversation in the Vernon Collection at LACMA

The Vernon Collection donated to the Los Angeles County Museum of Art, consists of over 3600 master works of the history of photography. The collection acquired an image of mine at a photography auction² in the 1990s. The image, titled "Conversation" produced around 1987, was one of the early works I realized on the Targa system. The whole process of digitally transforming and manipulating a photographic image through software was radically new, but nonetheless belonged to a long tradition of image alteration since the founding of the medium. One of the challenges of the photographic medium had been its uncanny resemblance to the real when it fact, as a product of technological creation, it is a constructed image. The early works therefore explored the potential of image transformation in such a way that there was little need to hide the manipulation, as it became quickly evident that digital images could be significantly manipulated without detection.





Decor, 1983, C color photographic image, 28.5" x 36.25"

Conversation George Legrady (1988), Ink-Jet print, LACMA-Vernon Collection

"Conversation" was based on an earlier work titled "Still Life" which I assembled out of studio props and photographed with a 4x5 camera around 1981. I was inspired to create the digital image based on my discovery at the time of Claude Shannon's definition of noise-and-signal as defined in his influential Information Theory (1948), a theory that has been instrumental in the development of telecommunications, and much of digital technologies today. The source image is a captured still from an Italian 1960s film in which the male and female actors (possibly Marcello Mastroianni and Sophia Loren) are having an argument I used text characters deformed through software and random, spatial positioning to convey the energy, the activity but also the "noisy" nature of their communication.

The transition from staged photography to constructed digital photography was a natural step for my way of exploring the digital image as it involved a process of construction and staging. At the time, there were very few artists working in the digital photography medium, that I knew of given that hardware with basic image quality was just beginning to enter the market and one had to write one's own software to process and manipulate digitized images.

The process of printing the image directly from computer-based data took place by transferring the data from the computer onto a 5 ¼" floppy disk, from which the data was transferred to tape and the Fuji inkjet printer would then read the tape to print the image. The Fuji Jetgraphix prototype printer was located at UCLA Professor Mits Kataoka's lab. Artists who printed on the Jetgraphix included the painter Lee Mullican, Robert Heinecken, Graham Nash and others.

Exhibitions (of early Fuji inkjet works on paper)

- . George Legrady: From Noise to Signal, USC Atelier, 1987
- . Photography of Invention, National Museum of American Art, Smithsonian, Washington, DC, 1987
- . Digital Photography, SF Cameraworks, San Francisco, California, 1988
- . Fotografie, Wissenshaft und Neue Medien, Kunstforum, Dusseldorf 1988
- . Honorable mention, Computer Graphics, Ars Electronica, 1989
- . "Virtual Memories: New Electronic Photography", curated by Mike Mandel, Friends of Photography, 1991

. George Legrady: From Analogue to Digital, National Gallery of Canada, Canadian Museum of Contemporary Photography, Ottawa, Canada, 1997-1998

² Vernon Collection, LACMA (1989). Other works in public collections have been acquired by the National Museum of American Art (1988); Canada Council Art Bank (1990); Santa Barbara Museum of Art (2017)

Resources

- . Beyond Photography, Gerald J. Holzmann, prentice hall, AT&T Bell Labs, 1988, http://www.spinroot.com/pico/
- . Composites, Nancy Burson 1986
- . An Introduction to Information Theory: Symbols, Signals and Noise, JR Pierce, Dover, 1980
- . Computers, Pattern, Chaos, and Beauty, Clifford A. Pickover, Dover 1990
- . Cult of Information, Theodore Roszak 198
- . Image-Music-Text, Roland Barthes, 1978
- . Mode of Information, Mark Poster 1990

. Scientific American, November 1973, "Recognition of Faces", by Leon Harmon, pp. 70-82, "How can a computer recognize a human face" was at the time explored but unanswered....

. All the studies and research between 1986 to 1989 eventually resulted in a paper "*Image, Language, Belief in Synthesis*" which I presented at the College Art Association first panel on digital media art in 1989, and which then was published in "*Critical Electronic Issues in Media*" edited by Simon Penny, SUNY Press. 1994.



Each Jetgraphix works-on-paper are 23 1/2 in. by 28 5/8 in. (60cm x 72.7 cm)