

# Generative Photography: A Systematic, Constructive Approach

Gottfried Jäger

**Abstract**—The author discusses a medium he has termed 'generative photography', whereby the photographic process does not simply reproduce objects, but generates new images. He traces the development of generative photography in relation to experimental photography, apparatus art and exact aesthetics, covering the period from the 1920s to the present. Examples of generative works by both established and younger artists in Germany, the United States and Poland demonstrate the traditional technological and aesthetic origins of generative photography and the emerging place of this alternative medium in those countries. The author recounts his career, discussing each stage of his own generative work which is based on both an unconventional aesthetics and the deliberate application of technical method.

## I. INTRODUCTION

I began to use the term 'generative photography' [1] to describe the photographic process not as a reproductive, but as a productive, 'generative' system. Its underlying idea can be found at the point where three trends in the development of art and photography intersect: 'experimental photography' since the 1920s; 'apparatus art' from the kaleidoscope to the computer; and aesthetic theory, especially 'exact aesthetics'. The medium has assimilated and developed each of these trends in its own specific way.

Generative photography is a kind of 'productive photography' that breaks away from the usual idea of the exactness of photographic reproduction. It no longer merely reproduces objects, but actually produces new forms. Generative photography rejects the conventions of an established medium and can be regarded as an alternative model for treating an apparatus-based and data-processing system in a creative fashion.

Generative tendencies in photography are an international phenomenon. In addition to the activities going on in the Federal Republic of Germany, there are comparable trends in the United States and Poland.

My main aim has been to explore and communicate the creative potential of the medium of photography, both in its artistic practicability and in its theoretical aspects in teaching and research.

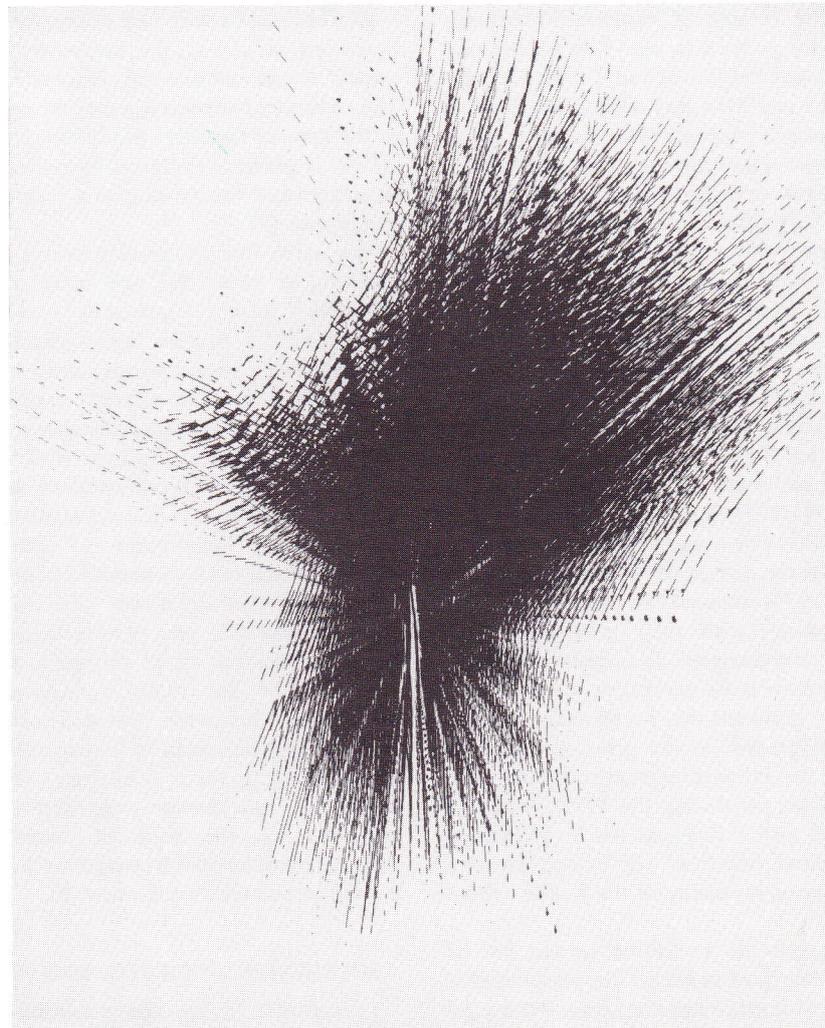
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## II. DEVELOPMENT AND HISTORY

Projects in generative photography reflect an analytical and methodical, rather than an arbitrary, approach. Elementary photographic compositional

parameters are systematically examined and integrated into the composition of the picture. This involves the use of formative techniques from areas that border on photography. The methods I prefer include the use of new, 'do-it-



**Fig. 1. Composition, light graphic work 2-170, gelatin silver unique, 30 × 24 cm, 1963. I have deliberately used scientific means such as exact apparatuses, picture sequence techniques and definitive programs in order to avoid overshooting the mark and to demonstrate the multifarious effective possibilities of the photographic process.**

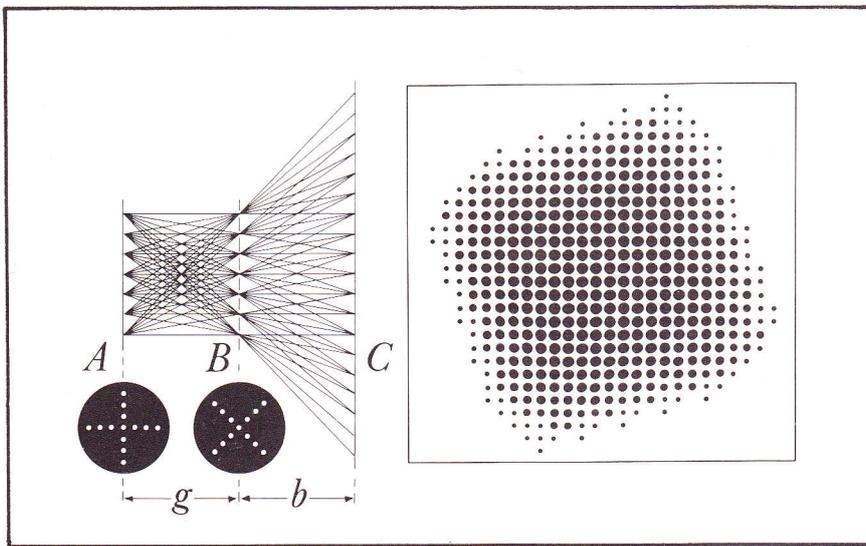


Fig. 2. Apparatus system of *Pinhole Structures*. Multiple pinhole camera combined with light pattern subject. A: Light pattern subject, variable. B: Multiple pinhole, variable. g: Distance A-B, variable. b: Distance B-C, variable. C: *Pinhole Structure*, result.

yourself' apparatuses combined with picture sequencing techniques and a clearly defined program.

The origins of experimental photography go back to the 1920s when artists such as Christian Schad, Laszlo Moholy-Nagy and Man Ray deliberately applied unusual photographic techniques to artistic compositions. They did this to achieve new photographic expression. Moholy, the artist-theorist, demanded: "Apparatuses (means) hitherto used only for the purpose of reproduction must now be developed for the purpose of production" [2]. The subsequent development of experimental photography in Germany after 1945 can be traced within the tendencies of 'subjective photography' in the 1950s, culminating in the light-graphic work of Heinz Hajek-Halke (1898-1983) [3, 4]. The exhibitions and publications on generative photography at the close of the 1960s and beginning of the 1970s rounded this out, methodically speaking, with their systematic, constructive analyses [5]. In historical terms, however, these generative works were a link between the purely experimental photographic works prior to the 1940s and the intermedial ideas and activities of concept art during the 1970s, which in their turn influenced the 'experimental medium reflexion' (1978) and medium analysis, especially of the Kassel School [6].

Apparatus art is the second line of development in generative photography. For a long time apparatuses and technical equipment have been used to realize artistic ideas. The early camera obscura, Dürer's drawing machine, various pendulum devices for drawing geometric

patterns, rose-engines, kaleidoscopes, the microscope and of course the still and cine cameras are all milestones along this road. The latest development in apparatus-based art is use of the computer for artistic design and musical composition. The computer has been accepted not only in the area of technical production, but also as a generative source, by evolving structures and functioning as a creative component [7].

The third line of development contributing to generative photography is aesthetic theory, especially 'exact aesthetics'. Its origins lie in classical antiquity when aesthetics was a branch of philosophy that attempted rational (Pythagoras, Aristotle) and metaphysical (Plato) explanations of beauty. With the help of scientific experimentation and mathematics, theorists in exact aesthetics are currently attempting to define objectively the basis of human aesthetic appreciation (informational aesthetics, numerical aesthetics, generative aesthetics). Generative aesthetics, as defined at the beginning of the 1960s by German philosopher Max Bense, provided part of the theoretical foundation for generative photography: the deliberate and methodical production of aesthetic structures on the basis of precisely defined (mathematical) programs with the aid of technical equipment [8].

### III. SIGNIFICANCE FOR TODAY

In contrast to the above-mentioned approaches, generative photography has its own independent artistic program. It is 'productive photography', breaking away from the traditional meaning of the

central photographic term 'exact reproduction', interpreting and extending it. It no longer merely reproduces objects, as does conventional photography, but produces abstract notions: thought pictures, theorems, models, ideas. It not only conveys an 'external' point of view but also an 'inner' point of view, an intrinsic picture of the pictorial system man/apparatus. And it represents the process of contention between man and apparatus on a highly symbolic level.

Generative photography creates a concrete, constructive photo language, with the purpose of bringing to light pictures that are latent in the photographic process. It represents a language inasmuch as its results reveal logical structures in picture sentences that are 'legible'. Generative photography creates a kind of syntactical system, a creative, visual grammar that produces new pictures and discloses as much about the intention of its author as the gradual materialization of the work does [9].

Generative photography does not imply an anarchical, destructive use of apparatus as found in some of the new alternative and neodadaist tendencies of contemporary art. On the contrary, it uses the constructive and creative appropriating ability of the apparatus. But its approach to the apparatus is by no means uncritical. It rejects stereotypical handling of an apparatus system that functions automatically only and accepts existing models without question. Generative tendencies in photography are an 'interference' in the existing photographic system in that they do not fit in with prevalent patterns and confront these with a different approach to the system. This, however, happens on a constructive level. The possibilities of the apparatus are extended and its creative potential is uncovered. The apparatus receives a new function; it is used for other purposes than originally intended. But it also receives—as does the person using it—new license and new tasks.

The photographic process has two sides. Its origins are to be found in the natural and technical sciences just as much as in philosophical and aesthetic cultural tradition. It is based on knowledge acquired from and achievements made in the natural sciences as well as on contemporary demands for communication, artistic expression and new visual experience. The visual results of the medium of photography can, as a whole, be regarded as the expression of the rich interchange between these cultures. The photograph can be considered an expression of the relationship

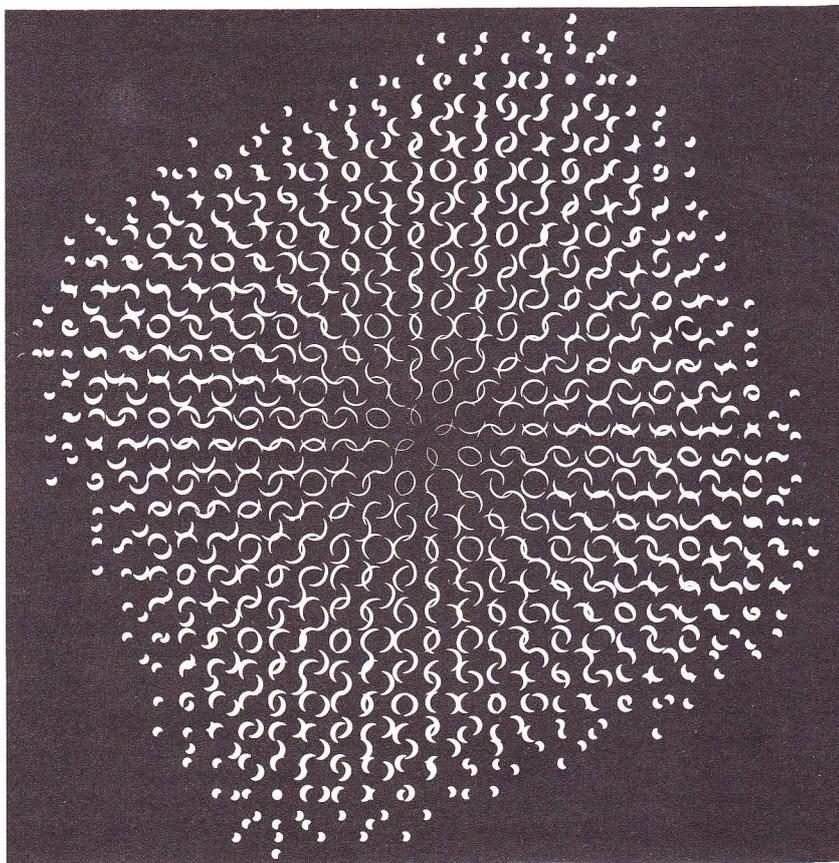


Fig. 3. *Pinhole Structure*, light graphic work 3.8.14, modification F 4.I, gelatin silver print, 50 × 50 cm, 1967.

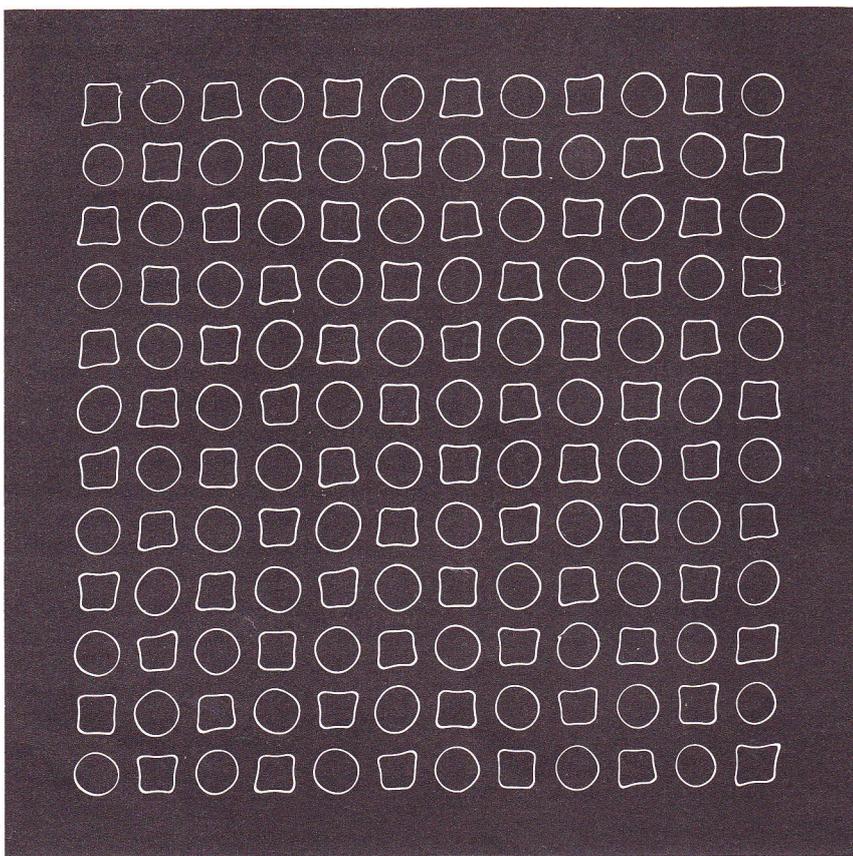


Fig. 4. *Grid*, light graphic work 6.7, gelatin silver print, 50 × 50 cm, 1973.

between apparatus and artist and between the rational and emotional needs which the photographer tries to unite in himself and use to achieve effect. The generative tendencies in photography bridge gaps not by making the apparatus absolute, but by giving it a significant role in this interplay as a 'creative factor'.

#### IV. ARTISTS AND INTERNATIONAL TRENDS

The 1968 Bielefeld Art Center exhibition brought together three German artists, Kilian Breier, Hein Gravenhorst and myself, and the Belgian Pierre Cordier. Breier exhibited permutational photograms, Gravenhorst showed his *Photomechanical Transformations*, I displayed my works based on the camera obscura and my *Pinhole Structures* and Cordier exhibited his *Chemigrams*, which have now attained widespread recognition. All these picture techniques were at the time classed as experimental photographic techniques. However, contrary to the products of experimental photography which were considered more coincidental and spontaneous, our methods were based on logical and scientific thinking that was exact in its approach. In order to characterize this, a new term—'generative photography'—was necessary.

Herbert W. Franke, a researcher into the science of art, formulated the background theory for this logical approach in his development of the theory of 'cybernetic aesthetics' in which the production and reception of art are closely interrelated. Cybernetic aesthetics is defined as a cybernetic feedback control system aimed at making perception 'successful' by extending it and increasing its degree of sophistication according to an 'optimizing principle'. In this way art has the social function of continually creating new and variable patterns, motifs and models which allow the process itself to take place. This approach corresponds to an anthropological interpretation of the phenomenon of art. Photography offers modern possibilities when it rejects traditional forms and goes new ways [10].

Younger artists began to work together with the early generative photographers and theorists to produce exhibitions and publications. Artists using an exact, analytical and constructive method of working include Karl Martin Holzhäuser, with his *Mechanical-Optical Investigations*, Albrecht Zipfel, with *Conical Projections* after 1969, and Rolf H. Krauss, with his work according to the principle of *Successions* after 1975 [11].

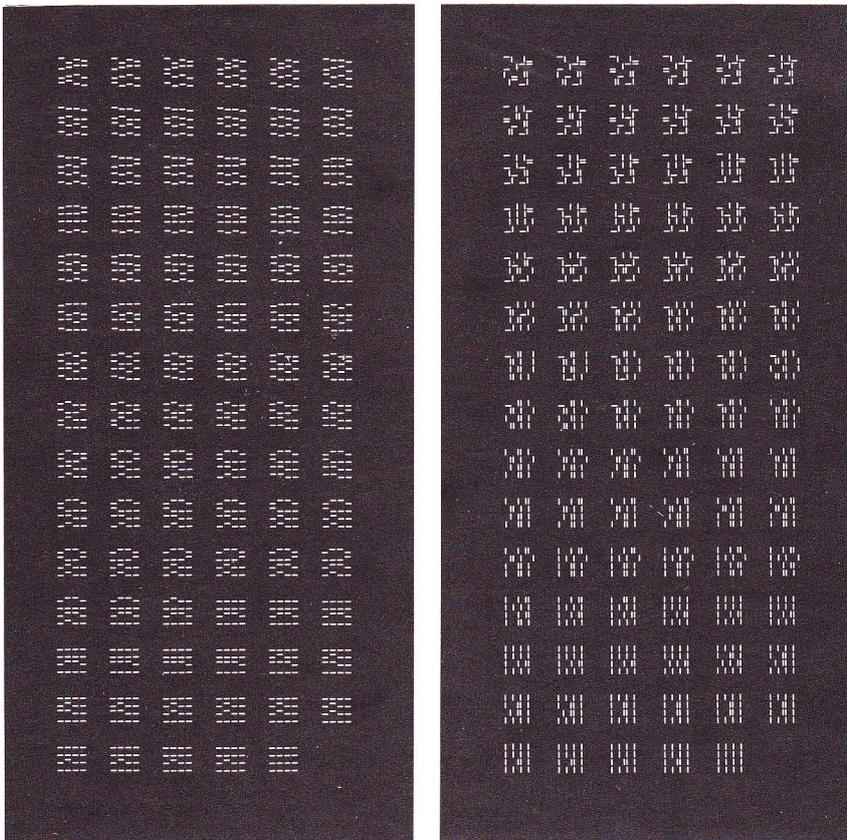


Fig. 5. *Play Strategies 'Selection'*, photo-aided apparative graphic work 89/1-6 (Detail 2, 3), silkscreen prints on paper, each 60 × 30 cm, 1977. This work originated on the basis of mathematically aided programs closely connected with an audio-visual project of simultaneous projections and original music.



Fig. 6. *Two Triangles: Spontaneous Production*, photo work IX/1983, 1-2, two silver gelatin sheets, each 25 × 25 cm, 1983. The sheets develop an exciting reality of their own if one allows them to express themselves, disregarding the rules for panel pictures and leaving them to determine their own rules.

The following German authors work within the bounds of generative tendencies, although they do not apply them strictly but prefer to go their own photo-compositional way: Klaus Kammerichs, with his *Photosculptures*, Manfred P. Kage, with *Polychromatic Variations* based on micro-photographs and crystal structures, and Floris M. Neusüss with his lively large-sized *Figure Photographs* [12]. Nikolaus Koliusis and Rolf Sachsse, with her concrete photographic works [13], are two of several young artists working in this genre.

In the United States the term 'generative systems' is associated with the name Sonia Landy Sheridan. She introduced this concept in 1970 with a program at the Art Institute of Chicago. She is primarily concerned with the social role and responsibility of the artist in a society which is to a large extent molded by science and technology:

The artist... has a responsibility to work with the scientist in developing the technology for human enlightenment. We have seen all too clearly how the dreams of scientists have been applied to produce a dehumanized environment. It is time that the artist redirected this application to genuine human needs... It is time to rekindle an earlier role of the artist, that of explorer and inventor. Anti-social technological adaptations of scientific discoveries, scientific specialization removed from the general human context—all these reveal a need for imaginative, socially sensitive thought in the development of new technologies. The Bauhaus paved the way for the artist's participation in the creation of functionally aesthetic, industrially produced objects. The next stage should be to directly affect that nature of technology, to determine what the technology should be [14].

Sonia Sheridan's own artistic products, the *Inner Landscapes* of her drawings or her 'generative systems', together with the works of her students, reveal a necessarily disrespectful handling of the apparatus. Their art demonstrates the playful ease, imagination and intensity with which these artists approach their work. The alternative use of various copy machines ('copy art'), the application of X-rays and high-voltage aggregates, the use even of computers and the re-discovery and contemporary use of older techniques all indicate that this path has long been trodden. I would like to mention three names representative of the many artists working in the U.S. in the area of generative photography: Gyorgy Kepes, with his fundamental book *The New Landscape in Art and Science* (1956) and his imaginative photograms dating from around 1940 [15]; Mary Jo Toles, a

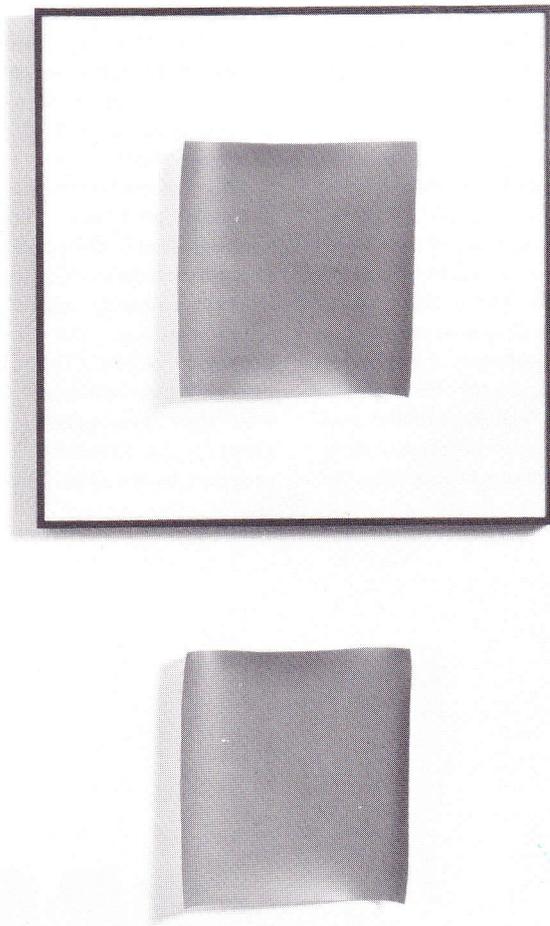


Fig. 7. *One Square: Production/Reproduction*, photo work XIV/1983, 2-3, one gelatin silver print, 50 × 50 cm framed, one gelatin silver sheet 25 × 25 cm, 1983. I enjoy working on the interplay of picture illusion and concrete picture reality, using the characteristic of exact photographic reproduction typical of the medium and questioning it at the same time.

young author who made her name in the early 1980s with *High Energy Photographs* [16]; and Jack Sal, with his rudimentary serial *Drawings* dating from 1977, which are based on the technique of Talbot's early *Photogenic Drawings*, dating around 1835 [17].

In addition to Germany and the United States, a third center of generative photography has emerged in Poland in the Foto-Medium-Art galleries in Wrocław under director Jerzy Olek, the Gallery 'gn' in Gdansk, and the Mala Gallery in Warsaw. A young generation of artists is raising fundamental questions about the photographic process, examining it and finally integrating it intellectually into their work. In this they approach the limits of what can be

thought and done. Here are just a few representative names: Zbigniew Staniewski, with his works entitled *Complex Photography* around 1976; Ir Kulik, with serial works on the photographic perspective, *Hovering Levels* (around 1977); Leszek Brogowski with his *Idioms*, tableau works which deal with the specific idiosyncrasies of photography in texts and pictures; and Andrzej Rózycki, whose work primarily deals with *Analytical Facts about Photography* and the *Photographic Conclusions* (around 1976) [18].

These younger artists are currently trying to transform the 'analytical elementarism' of recent years into a 'contemplative elementarism' (Olek) in order to avoid merely looking through or into the apparatus and examining it.

Their aim is to work *inside* the apparatus and to live within its possibilities and relationships. 'Insight Into Photography' is the new motto: "This 'within-photography' is one that evokes its own intensified being. It is no longer (as during its analytical stage) photography about photography, but rather, photography within photography, a self-orientation, a self-absorption" [19]. The elementary photographers of this school have freed themselves of the hegemony of photographic items—the objects—and, following a phase of analysis and reflection, retreat into the self-devised, self-contained inner system of their own medium, independent and self-critical. But perhaps this introverted approach, this introspection, means more than at first may meet the eye. Perhaps it is a response, a last bulwark of freedom in the face of the inaccessible and closed political system around them.

## V. DEVELOPMENT OF MY WORK

I trained to be an ordinary photographer and photo engineer, but very soon took an interest in the artistic possibilities of the medium. Over the years I have gradually devoted all my attention to this aspect and I now see it as my task to realize the creative potential of photography, both in the practical sphere and in the theoretical field of teaching and research.

During my studies I learned much about the elementary physical photographic process. It involves the interplay of light energy, crystal structures and electrical charges which produces a latent picture that can be further developed. These terms have assumed a considerably extended and overriding meaning for me. For example, the engineer, when talking of 'reversal processing', of the 'latent picture', of 'depth of focus', etc., has only the physical and technical aspects in mind. The artist, however, immediately recognizes their metaphorical import and sees them conceptually as 'pictures' by associating them with other areas of consciousness. These pictures are also 'latent pictures' inherent in the photographic process and far from 'developed'. The physical and technical development of photography is approaching its limits. It is increasingly being overtaken by the electronic media, the philosophical, artistic and metaphysical components of which are only just beginning to emerge.

The development of my practical work can be traced and understood in light of the above. I have always ventured into the nonconventional frontier of photography, but I have also deliberately used scientific

means such as exact apparatuses, picture sequence techniques and definitive programs in order to avoid overshooting the mark and to demonstrate the multifarious effective possibilities of the photographic process as illustrated in Fig. 1.

Influenced by the theories of exact aesthetics, I completed my first exact works after a phase of exploration in 1965. I derived the expression 'generative photography' from Max Bense's theory of 'generative aesthetics' [20]. During my studies prior to this, I was much influenced by Herbert W. Franke's book *Art and Construction – Physics and Mathematics as a Photographic Experiment* [21] (1957). This book encouraged me to allow the fields of culture, art and technology not to thwart but to complement each other. I drew on their interaction as the source of my own activities.

I thereupon devoted myself entirely to 'elementary photography', which deals with the basic compositional possibilities of the medium. Elementary photography is concerned with investigating the effects of light and shade, the possibilities of waves and diffraction, and the phenomena of luminous colors, among other things. I called my first comprehensive work in this field *Pinhole Structures*. These works were based on the use of the original camera, the camera obscura. Combined with other photographic effects and modifications, they showed pictorial structures that were complex, detailed and highly sophisticated. I completed about 300 works based on this principle during the period 1967–1973. The basic pictorial pattern was the dot in the shape of a luminous point (see Fig. 2), its blurred extension in the shape of the circle of the pinhole (see Fig. 3), and the effect of small oval discs produced by it (Fig. 4).

A more theoretical phase followed during which, in addition to numerous lectures and essays, I wrote two books, *Apparatus Art—From the Kaleidoscope to the Computer* with co-author Herbert W. Franke (1973) [22], and *Generative Photography – Theoretical Foundation, Compendium and Examples of Photographic Pictorial Composition* with co-author and colleague Karl Martin Holzhäuser (1975) [23].

I was increasingly on the lookout not only for new photographic possibilities but also for other forms of artistic expression. For example, my *Apparatus Graphic Works* originated on the basis of mathematically aided programs (see Fig. 5). Closely connected with this work was an audio-visual project consisting of

simultaneous projections and original music in cooperation with composer Walter Steffens and K.M. Holzhäuser. We called the work *Play Strategies* and it had its premier in 1972 at a congress on scientific photography in Munich. The work is an artistic adaptation of a game of dice called *Selection*. This game is a model which German Nobel Prize winner Manfred Eigen and Ruthild Winkler describe in their book *Laws of the Game: How the Principles of Nature Govern Chance* (1975) [24]. Using this model, they simulate and demonstrate certain laws of nature in the process of evolution.

At the beginning of the 1980s I was working on *Color Systems*. My idea was to apply the theory of chromatic light directly to color images. Generally the

photo represents the colors of the objects represented. Many works from the field of experimental photography also have colors with this representative character. I wanted to represent the color itself, however, and produce it directly on the photographic layer that is sensitive to chromatic light.

This process has its own technical and aesthetic problems. Luminous color, which is used in the photo process and is recognizable as such, is transformed into its complementary color so that a colored 'counter-picture' with inverted colors becomes visible (Type C-print). The intention to produce color directly in this way thus presupposes some 'license' given to the apparatus, or rather to its program, by the artist. Thus the apparatus

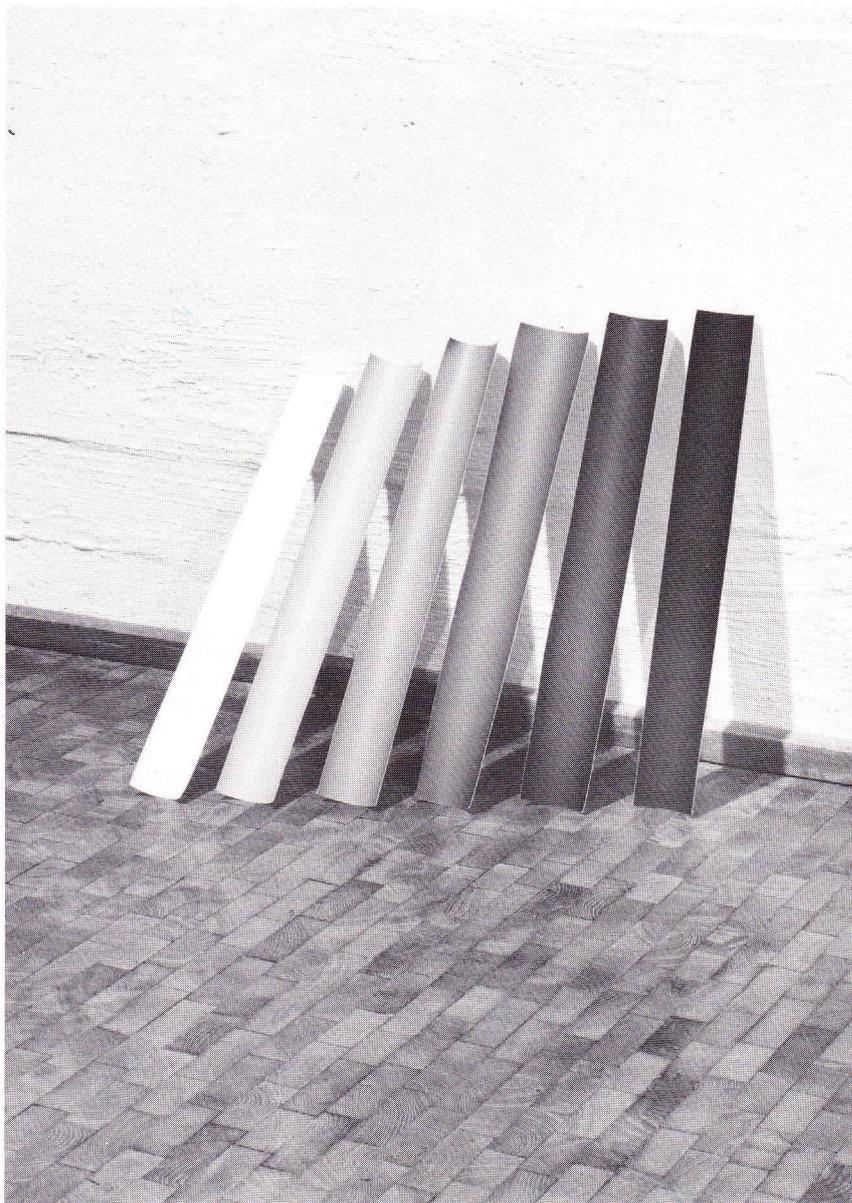


Fig. 8. *Gradation: Theory/Practice*, photo work XXI/1983, 1-6, six gelatin silver sheets, each 50 × 8 cm, installation 50 × 100 cm, 1983. I have conducted investigations into the possibilities of developing photographic installations in space.

can do for the coloring effect—within certain controllable limits—what it considers 'right' within the rules of the program. Color is not applied deliberately, but is a product, a result of the program.

In this way I created a series of light-graphic unicas, the composition and characteristic features of which are to be found in the strictly serial and programmatic method of working. The pictures were created in the darkroom with the help of a multiple lens carrying up to 12 identical lenses set in a geometrical pattern. Some of these works are entitled *Color Cycle* (1980), *Spectral Course*, *Color Development*, *Color Reversal Development* (all 1981) [25] (see Color Plate A, No. 1).

At present I am discovering a new photographic parameter, the drying process. As a rule photographs appear as flat, panel pictures, which are stretched, pressed and framed. They are rectangular and have parallel edges. Yet they develop an exciting reality of their own if one allows them to dry unconstrained, disregarding the rules for panel pictures and leaving them to determine their own rules (Fig. 6).

I enjoy working on the interplay of picture illusion and concrete picture reality, using the characteristic of exact photographic reproduction typical of the medium and questioning it at the same time, as illustrated in Fig. 7. I am also interested in reflex and shadow structures on the surfaces of my materials, and I use their effect to allow new surface landscapes to emerge. Following from this I have also conducted investigations into the possibilities of developing photographic installations in space (Fig. 8), a task that is by no means finished.

As a result of my being preoccupied with these phenomena, my works have acquired increasingly simple forms. Having worked with dotted structures around 1970 and with geometric linear structures and color systems around 1980, I am now more interested in pure surfaces, which in my view have a valid expression of their own. If one observes surfaces closely, one may see phantasmal images: reflexes that are continually changing; nuances of light which depend

on lighting effects; contours that become stronger or disappear completely according to the play of external light and shadow, which overshadow the 'picture' and allow a new 'picture' to emerge—a picture within a picture.

The composition here consists of a system of variable surface elements that are not fixed. Instead, at the most they assume concrete shapes only for a moment, perhaps for the duration of the exhibition. They can be used again, they can be developed further, they can continue growing and unfolding. The surface elements are in a state of response only for the moment. It is their task to have a generative effect. In the continuing process of renovation, of renaissance, they constantly provoke generations of new forms. No cessation, nothing final, is intended. Instead there exists something prevailing, continued in a state of development: the aesthetics of transition. It is the inner urge to develop and find new incentive for my personal and specialized ambition that constantly inspires my work.

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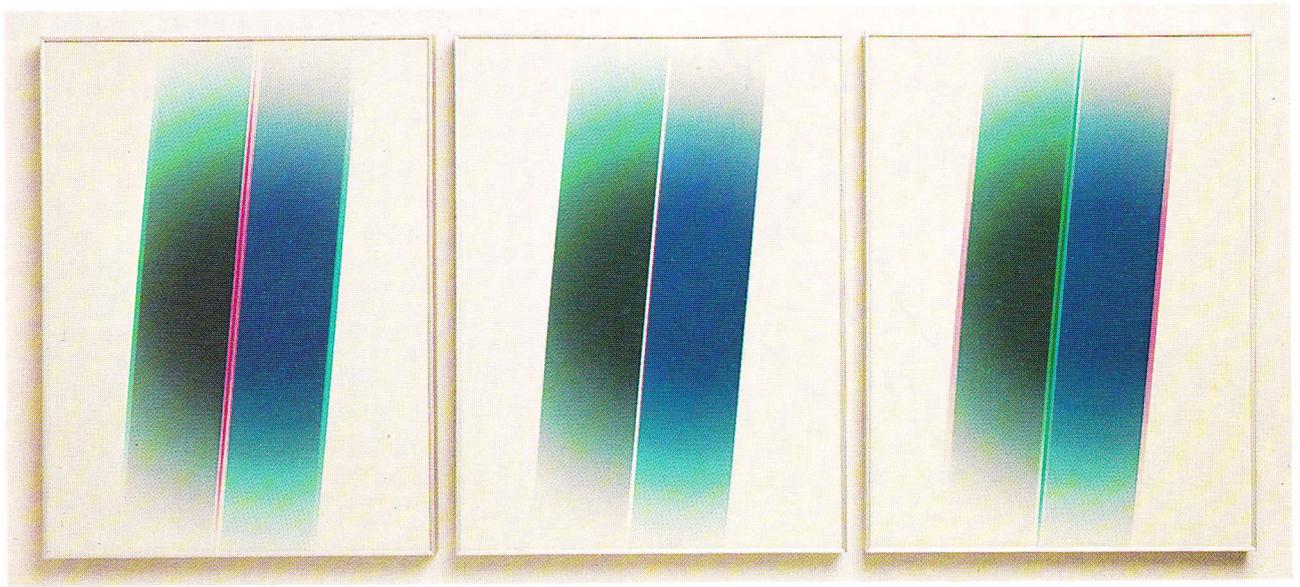


Plate A

No. 1. Top. Gottfried Jäger. *Color Reversal Process*, light graphic work XIV/1981, 1-11 (Detail 5-7),  
type C. prints, each 40 × 30 cm, 1981.