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CHEMIGRAM: A NEW APPROACH TO LENSLESS PHOTOGRAPHY

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Abstract—*The author describes his lensless photographic technique which he calls the* chemigram *technique. His research, in which chance plays an important role, is characterised by a displacement of the values of each step in making a photograph. Usually, a photograph is produced through exposure to light, and the subsequent chemical operations contribute only to making the latent image permanently visible. But, for the author, the latter become the generator of the image. Light takes on a secondary role. The essential elements in his work are: photosensitive materials, chemical solutions and localizing materials. The techniques are para-photographic; they are more related to engraving, painting, lithography, etc. than to photography itself.*

I. DEFINITION

I invented the chemigram technique in 1956. In 1958, Otto Steinert suggested that I exhibit three pictures at the Cologne Photokina for 'Subjektive Fotografie III'. He called them 'Chemo-Fotogramme'. A few weeks later, I chose the term 'chimigramme'. (This French term and its English equivalent 'chemigram' are registered trade marks.) Etymologically, a chemigram is a written or drawn chemical sign. The word comes from 'chemistry' and the Greek '*gramma*', meaning writing. In fact, any graphic sign obtained by chemical reaction (a spot of rust, corroded copper, crystallised salt, etc.) could be called that, but, to date, I have limited myself to chemical reactions on photographic emulsions. A chemigram owes its existence to the localized action of chemical substances (developer, fixer) on a photosensitive surface, without the use of the camera, enlarger or darkroom. The word 'chemigram' refers to both the technique and the resulting image.

II. LENSLESS PHOTOGRAPHY [1]

In 1923, Laszlo Moholy-Nagy wrote: 'The photogram is the true key to photography. Its possibilities could be greatly extended with these new discoveries' [2]. The first lensless photographs were made before the invention of photography itself. Towards 1725, Johann Schulze applied stencils made of opaque paper on a bottle containing silver salts. After being exposed to light, the blackened salts would reveal the patterns and words cut out in the paper [3]. Hippolyte Bayard (1801–1887) made the same type of experiments in his youth but used ripening fruits. Fox Talbot, towards 1839, used feathers, bits of cloth and flowers to make his 'photogenic drawings'.

Around 1918, Christian Schad ('schadograms') and, in 1921, Man Ray ('rayograms') and Moholy-Nagy ('photograms') reinvented lensless photography. Man Ray described how to make this sort of picture. In the dark, one places any kind of object on a sheet of photographic paper. Light is then projected on the whole. The objects that have been placed protect the sensitive surface and so do the shadows cast by them. Once the paper, thus exposed, is developed, the rayogram appears outlined in white and graduated in very delicate gray values. One can object that that is not true photography. Indeed, camera and lens are not involved. The rayogram is a marginal procedure in which each picture is an original. 'It is a synthetic rather than an analytic process, a tributary of the main stream of photography in which the camera has been the indispensable instrument, second in importance only to the photographer's eye' (Beaumont Newhall) [4]. Indeed, it seems obvious that these creators not only sought new forms of expression but also wanted to transgress the conventions of traditional photography.

Louis Ducos du Hauron, in 1888, made 'anamorphoses', veritable photographic disfigurements that, according to him, would reveal 'a vision of another universe' [5]. Alvin Langdon Coburn, in 1917, realized the first non-figurative photographs, 'vortographs', 'stranger and more fascinating than the most fantastic dreams' [6]. Using a technique already known by some painters around 1855 (Corot, Millet, Delacroix, etc.) Gyorgy Kepes since 1943 has made 'clichés-verre', which are images printed from negatives that were hand-drawn or painted.

All this para-photographic research introduces us to a reflection on the nature and functions of the photographic image. In a parallel way, some painters have overturned pictorial conventions: Turner, Cézanne, Picasso, Paul Klee ('genius is the error in the system'), Jean Arp ('we sought new materials unburdened by the curse of pictorial tradition' [7], Malevitch, Mondrian, Marcel Duchamp, etc. Traditional methods particular to each means of expression are no longer considered immutable by the 20th-century artist. Nowadays, one can witness the reconciliation of various disciplines; conventional borders are being over-run (painting–sculpture, painting–photo, photo–painting, etc.). Michel Seuphor: 'Art can be anything, but in a certain manner'.

III. PHOTOGRAPHY AND CHEMIGRAM

Traditional photography requires light, a camera in which the image is formed, the sensitive emulsion in which the latent image is realised, the developer which makes the image visible and the fixer that makes it durable. Therefore, light more or less acts upon certain parts of the emulsion while the developer and the fixer have an effect on the whole photosensitive surface. In the chemigram, light plays a passive role on the whole surface while the developer and fixer are used to produce a localized effect.

Can one still speak of 'photography'? From a purely physical point of view, yes. *Photo-graphy* means to write with light, and, although light is passive in the chemigram technique, it is still necessary for forming an image. Furthermore, the material used is the same (emulsions, products). Whatever the case may be, these distinctions are academic and the basic differences reside in the creative process.

Let us compare a photographer's creation with that of a chemigram-artist. A photographer is attracted by the sight of an old wall (much like Leonardo da Vinci had been in his time), and he photographs a crack in it. He was able to see the crack and

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make it conspicuous through the photographic technique: lighting, framing, exposure, development, printing. But he did not create the crack, and, had he wanted to produce it, he would probably have had to wait a long time under conditions difficult to acquire. Such, however, is possible for the chemigram-artist. Instead of going out to look for a nice crack, he creates the conditions most suitable for its formation on photosensitive emulsion. Thus, the latter not only becomes the wall (prop for the crack) but also the photographer's negative (as the prop for the inscription of the image due to the localized action of developer and fixer). And these two chemical reactions (crack and inscription) simultaneously interpenetrate under the chemigram-artist's active or passive supervision (Fig. 1).

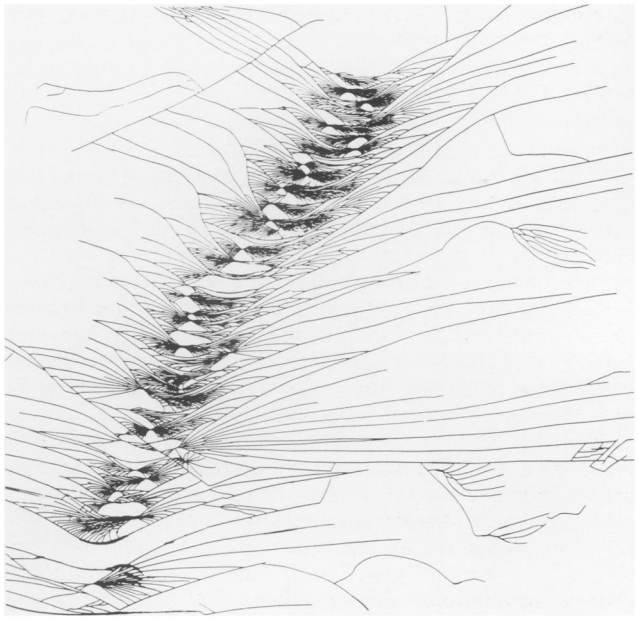

Fig. 1. 'Chemigram 18/12/62', 10 × 12 cm.

IV. PAINTING AND CHEMIGRAM

Rid of camera, enlarger and darkroom, the chemigram-artist before a blank sheet is faced with the same problems as the painter: what motive, what composition, what forms, what structures, what colors to choose? Another analogy: a chemigram is a unique image. Obtained directly on the emulsion, it cannot be separated from its support, just as a pictorial image can't be.Furthermore, although it is possible to create similar chemigrams, they will never be identical (as may be two photographic prints of the same negative). In fact, the conditions that are brought together to obtain chemigrams vary constantly (products, temperature, physical-chemical reactions, etc.).

One of the (apparent) superiorities of painting over photography is that the former retains, in the paint itself, a trace of the painter's work. Unless it is dissolved, scratched or torn, a chemigram's emulsion shows no more of the trace of creative work than does a photo. However, while the painter's canvas is an inert, inactive material, a photosensitive emulsion is alive. The chemical products that constitute it make it possible to obtain unlimited variations in form and color.

Although a photograph is registered in an instant, a chemigram has the following in common with a painting: its forms and colors appear progressively, gradually, like the slow deposit of alluvium, like erosion of rocks by sand and wind (Fig. 2). The making of a chemigram may be modified at any time by changing the solutions, varying their temperature, by intervening manually or with instruments, etc. While the painter's hand traces the lines and fills in the surfaces one after another, the solution in which chemigrams are immersed simultaneously attacks different parts of the emulsion. Thus, within a few minutes, one can obtain an image whose structures are so numerous and fine that no photographic reproduction could compare with the original.

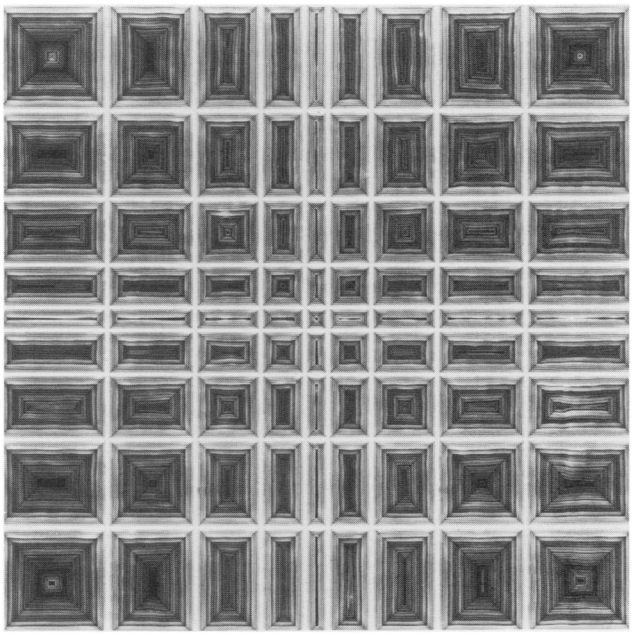

Fig. 2. 'Chemigram 7/10/72', detail, 14.5 × 14.5 cm.

V. CHANCE

The part of the unforseeable inherent to all true creation.
(Michel Seuphor)

You know, no one in the world can eliminate chance since life itself is a chance happening. But one can control, direct, accept or refuse chance.
(César [8])

Chance only favors a receptive medium.
(Pasteur)

At the time that I started making my first chemigrams, there was still no talk of 'aleatory' art, 'random' or 'open works'. Yet I was at once seduced by the adventure of systematically using chance. I arranged certain materials on a sheet of photographic paper, and I immersed it in different solutions, making images appear. Day after day, I took notes to be able to obtain the same images at will or rather, the same kind of images.

I think a chemigram corresponds well to Umberto Eco's definition of an 'open work': a work deliberately conceived so that one or several elements of chance can be introduced to modify its structure [9]. I have often been taken to task for giving such an important role to chance in my research. Although I am indifferent to such criticism, I would like to answer here.

First of all, by taking notes, I try to reduce the amount of chance, to cultivate it, adapt it, control it according to a certain goal I have set for myself. 'In our work we are constantly discovering new effects which often result from mistakes. There is no other way to cultivate mistakes than to intentionally repeat them until the percentage of the accidental element becomes so small and our control so precise that with a good conscience we can again call the picture our own' (Ernst Haas) [10]. Second, I

cannot conceive of the chemigram as anything other than aleatory; it is part of its nature and chance will always remain my best collaborator. Finally, I could point out that many have tried to integrate chance with art. In music, John Cage says that he has used chance to rid himself of his own intentions and to attain a 'silent music' [11]. Earl Brown, Karl-Heinz Stockhausen and Iannis Xenakis call it 'stochastic music'. 'I use the computer as a partner in my work' says Manfred Mohr [12]. 'Randomness is in fact a fundamental idea of the twentieth century, it is in the heart of biology, it is in the heart of new arts. This is understandable: by meeting with chance an artist strives to arouse and awake genius' (Edgar Morin) [13].

VI. PSEUDO-PHOTOGRAPHY

The incredible but true is not art, while what is untrue but likely can be.

(Alexandre Alexeieff)

Materially, a photograph appears as a flat image comprised of marks: dots, lines, more or less dense and colored areas. So does a chemigram. With a camera the marks are produced automatically in such a way that the image resembles the subject photographed. Sometimes, the resemblance is such that one can confuse the subject and its photograph. A chemigram is obtained without the use of a camera (without any bearing on visible or invisible reality) but with the same chemicals and on the same emulsions as in photography. Therefore, when I succeed (by dosing with developer, fixer and dyes) in suggesting the light, the material, the colors, the outline, the depth of things, I obtain a chemigram that is similar to a photograph: a 'pseudo-photograph'. Indeed, one doesn't doubt the 'reality' captured by photography, and a spectator looking at a chemigram will react the same way as he does looking at a photo. He will believe in the 'reality' of what is shown. This allows him to dream, to go on a 'photo-safari' while sitting in his armchair, to see what René Magritte called 'the unexpected images of the unknown' [14] (Fig. 3 and Color Plate No. 2). My chemigrams appear as fictitious photographs of an imaginary, improbable and inaccessible world.

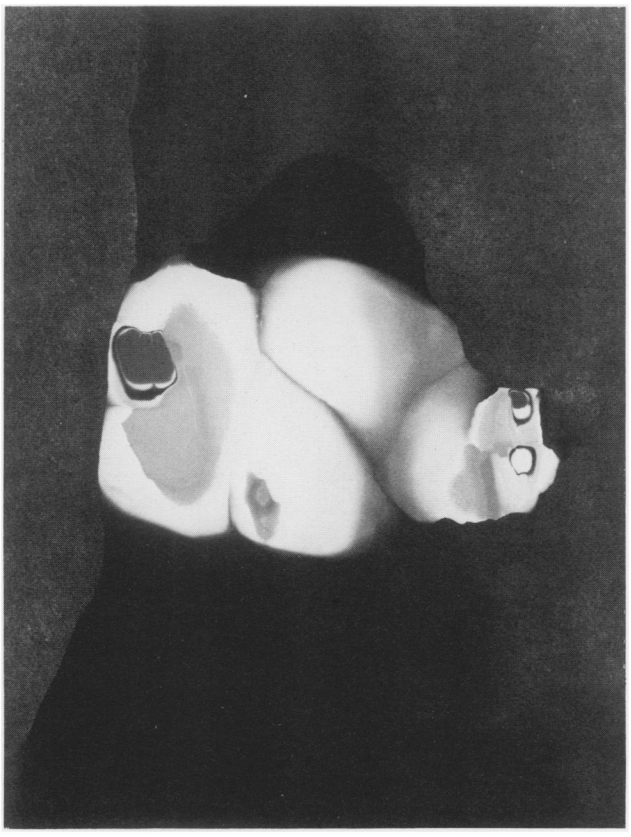

Fig. 3. 'Chemigram 28/5/61', detail, 9 × 7 cm.

VII. CHEMIGRAM TECHNIQUE

According to Moholy-Nagy, a photogram 'is the most completely dematerialized medium which the New Vision commands' [15]. Yet it seems that the chemigram, freed of the camera, the enlarger and the darkroom, would be the most elementary technique to create images with photographic material. When I invented the chemigram, I was an amateur without training and without set ideas I was thus able to transgress photographic practice by:

(1) *Mistreating the photographic material.* Photographic emulsions are more sturdy than they appear and will endure being scratched, dissolved, torn, cut, folded, etc. Man Ray said: 'The violation of the medium employed is the most perfect assurance of the author's convictions' [16].

(2) *Eliminating the darkroom.* To make chemigrams, light is in fact required in the room in which one works.

(3) *From fixer to developer.* It is photographic doctrine not to reverse the developer/stop bath/fixer/washing sequence. Yet this practice is common in the chemigram technique. The only inconvenience is that one must replace the chemicals more frequently.

(4) *Blending different graphic techniques.* Preoccupied with photographic technique, photographers often do not work in other art media. The chemigram is, like Marcel Duchamp's Mixed Media, a hybrid. The French photographer Daniel Masclet said: 'The bad photographer ignores the rules, the good respects them, and the great breaks them.'

Chemigram techniques involve the combination of three basic elements:

(1) *Photosensitive materials.* Any photosensitive surface can be used (paper, film, plates, textiles, aluminium, etc.). Each material will yield original results. Chemigrams on transparent material can be contact printed or enlarged.

(2) *Chemical solutions.* These are used in developing, fixing, coloring, toning, weakening, strengthening, bleaching and dissolving of photographic emulsions. I use the developer like a crayon and the fixer like an eraser. The fixer, however, is a peculiar eraser as you must use it before the developer. The effects of the chemical solutions can be varied by changing their composition, concentration, temperature, agitation and period of use.

(3) *Localizing substances.* They determine the designs, structures and patterns of the chemigram by more or less masking or exposing certain parts of the photosensitive surface. They perform a similar role to that of the negative in photography: instead of controlling the amount of light, they control the attack by the chemical solutions on the emulsion. The localizing substances are numerous, and they can be soft, hard, dry, sticky, brittle, etc.

By varying separately or together these three basic elements, the creative possibilities are endless. However, I would like to caution the reader that great patience is required and that the element of chance in this process results in a significant portion of failures or uninteresting pictures that should be discarded. Certain techniques that I tried were abandoned because of the high proportion of poor quality pictures produced.

In 1970, I made a series of extremely simple images which I

called 'Minimal Photography'. I tried to demonstrate that the chemigram is the easiest way to obtain an image with photographic material. An explanation of the method I used to make these images can serve well as an introduction to the chemigram technique: (1) White paper. Without exposing it too long to light, the photographic paper is immersed directly in the fixer. (2) Black paper. With full exposure to light, the paper is immersed in the developer. (3) Gray paper. The paper is immersed in a diluted developer. (4) Blue or purple paper. The photographic paper is exposed to very bright light. (This is called 'photolysis'.) Each emulsion type and contrast grade of paper will colour differently: silver chloride emulsions become purple and silver bromide emulsions become blue. (5) Beige paper. When a photolyzed paper is immersed in the fixer, it will not turn white, as one would imagine, but rather beige. (6) Yellow or brown paper. Reversing photographic practice, one transfers the paper from the fixer to the developer. A short stay in the fixer (a dozen seconds) will produce a brown tint and a longer stay (half a minute) a yellow tint. (7) Gradations from white to black through yellow and brown. The paper is immersed slowly into the fixer so that the top of the paper is fixed longest and the bottom the least.

Another method of making elementary chemigrams is what I call 'chemiscript'. If, in the light, one draws or writes on the photographic paper with a brush wet with developer, one will obtain black marks on a light background. By using more concentrated or more dilute developer, one can control the tones, as in making a watercolor. When the results are satisfactory, the paper is then fixed. To obtain white markings on a dark background, one reverses the method.

The true challenge in making chemigrams is to determine a form through a localizing substance. In the series 'Minimal Photography', I demonstrated that it was possible, without a camera, darkroom, or pencils, to inscribe a square within another square. If someone wishes to take a shower without wetting his hair, he wears a waterproof cap; this is the basic principle of the chemigram technique.

To obtain a white square on a black surface: I cut a square out of an adhesive-backed plastic. I press it onto the middle of a photographic paper. I immerse the paper in the developer. Except for the portion covered by the plastic, the paper will become black. I transfer the paper to the stop bath and wait until the plastic is easily removed. Then I fix and wash the paper. To obtain a black square on a white surface, the paper with a square adhered to it, is immersed first in the fixer and then in the developer.

To obtain a white square, delineated with a thin black line, on a white surface: I press a plastic square onto the middle of the paper. I immerse the paper in the fixer for a normal fixing time, then wash it for approximately 5 minutes. I place it in the developer. If the plastic is transparent, I will be able to see a thin black line form along the square. I transfer the paper to the stop bath, remove the adhesive, and fix definitively. How did the thin black line form? From the action of the water and developer, the plastic gradually came unglued along its edges. The developer was able to reach part of the emulsion that had not been fixed and thus blacken it. This is an important effect in the chemigram technique.

For more elaborate chemigrams, it is possible to replace the adhesive plastic with other localizing materials. Personally, I prefer those which do not protect the surface too well. Particularly useful ones are those which peel off, dissolve, erode, melt, scratch, break, bend, etc.

Another important effect is illustrated when each bath affects a different area, darkening with developer, lightening with fixer. One can continue alternating from one bath to the other until the localizing material has disappeared. It is possible to read the history of growth of such a chemigram as one reads the age of a tree by counting the concentric rings.

VIII. COLOR CHEMIGRAMS

The tones that appear in the chemigrams mentioned above are the result of chemical reactions such as oxidation, photolysis, etc. These tones (yellow, brown, blue, beige) are not bright but resist quite well attack by light. To obtain brighter colors, one can adapt many old and new photographic techniques (toners, dyes, etc.). Since 1961, I have used the dye-coupler developer process which gives bright colors, but, unfortunately, they are unstable to light.

A photographer has the advantage (and handicap) of capturing simultaneously all the colors of a given subject matter (landscape, still life, portrait, etc.). Of course, he can influence his results by choosing his subject, film emulsion, filters, etc. He can also modify the resulting image by a particular method of printing.

In my work, I begin with a blank sheet of paper. Sometimes, as in my earlier chemigrams, I let chance select my colors. Most often, however, I choose my colors before starting to work, and I find myself like the constructivist artists who visualize their composition before its creation. In order to choose the different colors that I will use in a chemigram, I spend a good deal of time: (1) experimenting with the materials (emulsions, developers, color dyes, localizing substances, etc.); (2) scrutinizing small details in nature and photographs of them (by me and others): stones, insects, pebbles, rot in old houses, decaying walls, scarification on leaves, etc., and in general anything dealing with stratification; (3) learning from the painting of great modern artists (Paul Klee, Nicolas de Staël, Max Ernst, Albers, Turner, etc.); (4) studying the theories of color such as those of Goethe, Chevreul, Munsell, Itten, etc.

IX. PHOTO-CHEMIGRAMS

In chemigrams, analogies can mostly be found in what Gyorgy Kepes calls the 'New Landscape' (macro and microphotos, crystalgraphs, vegetable sections, aerial views, etc.) [17], but analogies with human reality are very rare.

For this reason, in 1963 I invented a way to transfer any image (drawing, photo) onto the photographic emulsion so as to be able to then treat it as a chemigram. These are 'photo-chemigrams'. Man Ray said: 'I paint what can not be photographed. I photograph what I do not wish to paint' [18]. Likewise, what I can't obtain with chemigrams I obtain with photo-chemigrams. Like many painters, I choose my motifs in reproductions of paintings or photos, and sometimes I use my own photographs.

I have made series based on a child's face, a nude, a toboggan, 16 mm. film strips (Fig. 4), astronauts' heads ('cosmograms') and Andy Warhol ('warholograms'), and other series entitled 'Hommage à Muybridge' (Fig. 5), 'Hommage à Nonyme' (Fig. 6), 'Hommage au Docteur Land' (Fig. 7), 'Hommage à Marey' (Fig. 8), 'Sexquence', 'Livrillisible' (Fig. 9), etc. Photo-chemigrams may come from the same basic image, where each one is processed separately. For example, I can add different structures in the motif and/or in the background. Chance helps me to transform the image in a radical way. 'It's as if the image, starting from its outward appearance, was going on a trip through a new dimension' (Valerio Adami) [19].

X. DIFFUSION

In photography, certain artists print limited editions or even a single print (sometimes by symbolically or actually destroying the negative). This practice, long used by engravers and lithographers and nowadays employed in silk screen, to me seems contrary both to the very nature of photography and to the concept of democratization of art. Because a chemigram is by its very nature unique, the problem of limiting the number of prints does not come up. On the other hand, while uniqueness

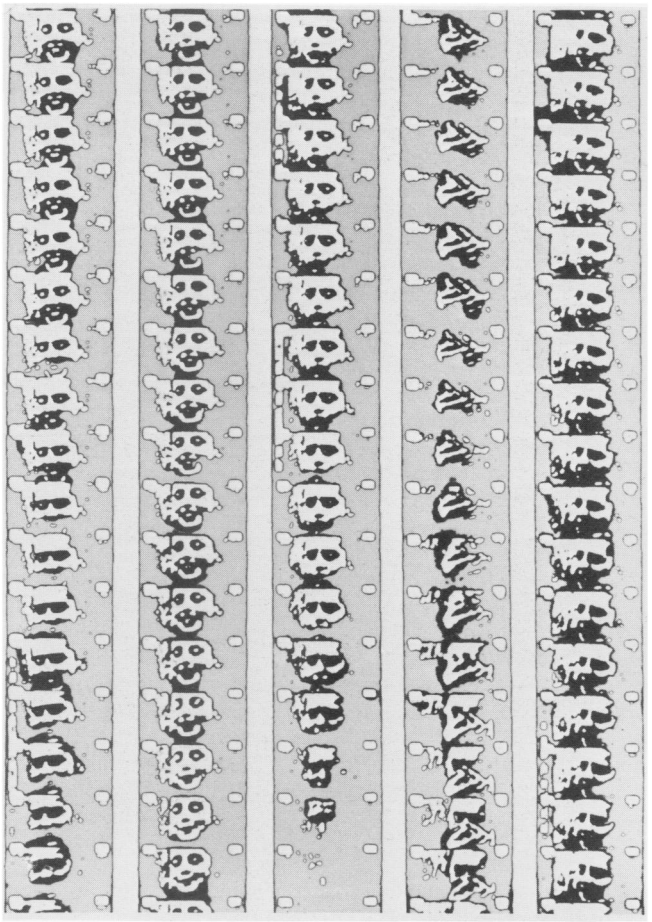

Fig. 4. 'Photo-chemigram 1966, "Olivier 16 mm"', 25.7 × 20 cm.

Fig. 5. 'Photo-chemigram 6/10/77 II, "Hommage à Muybridge 1972"', detail, 9 × 14 cm.

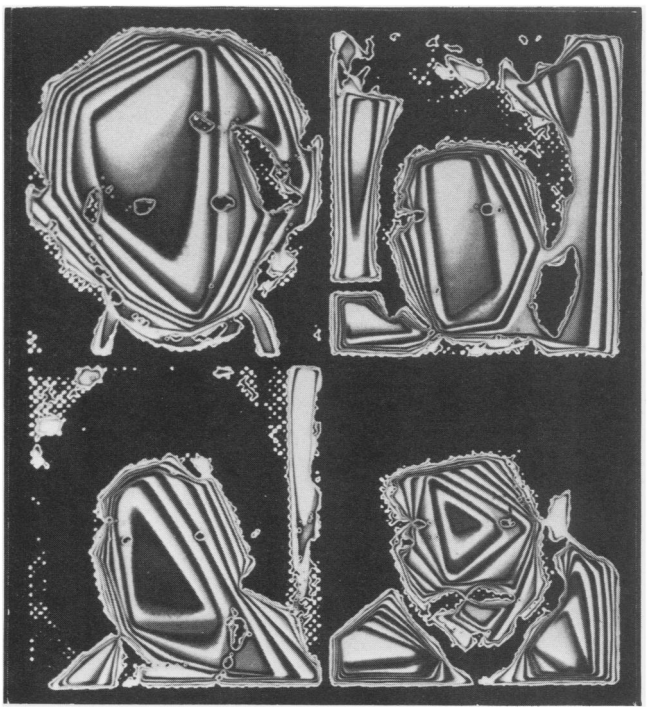

Fig. 6. 'Photo-chemigram 16/12/73 I, "Hommage à Nonyme 1972"', detail 4.5 × 4 cm.

Fig. 7. 'Photo-chemigram 16/5/76 II, "Hommage au Docteur Land"', 12.5 × 10 cm.

Fig. 8. 'Photo-chemigram 27/9/78 V, "Hommage à Marey 1975"', detail J8, 4.5 × 4.5 cm.

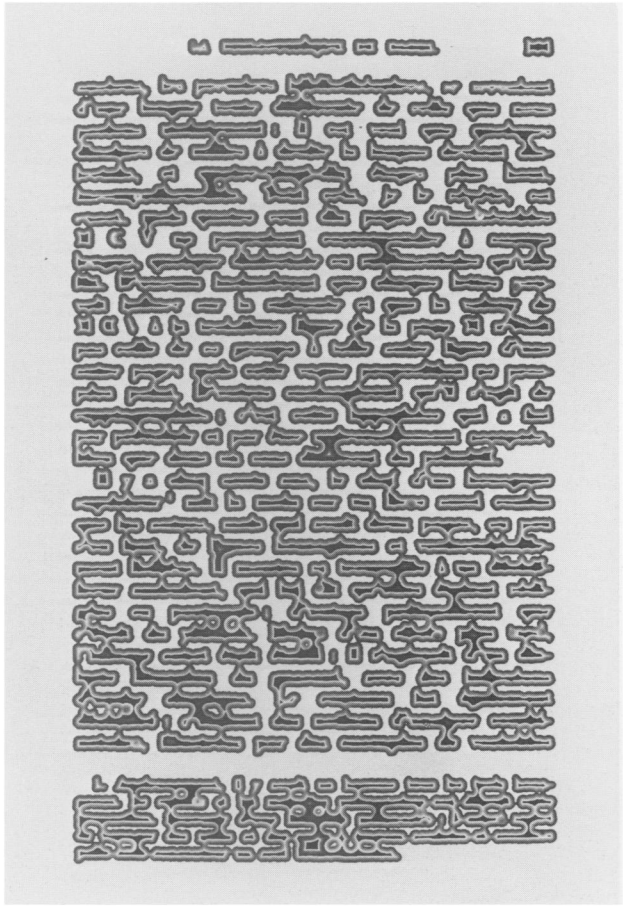

Fig. 9. 'Photo-chemigram 28/9/78 II', Fifth page of the 'Livrillisible 1964' from the novel by Jorge Luis Borges La bibliothèque de Babel, *17 × 11 cm.*

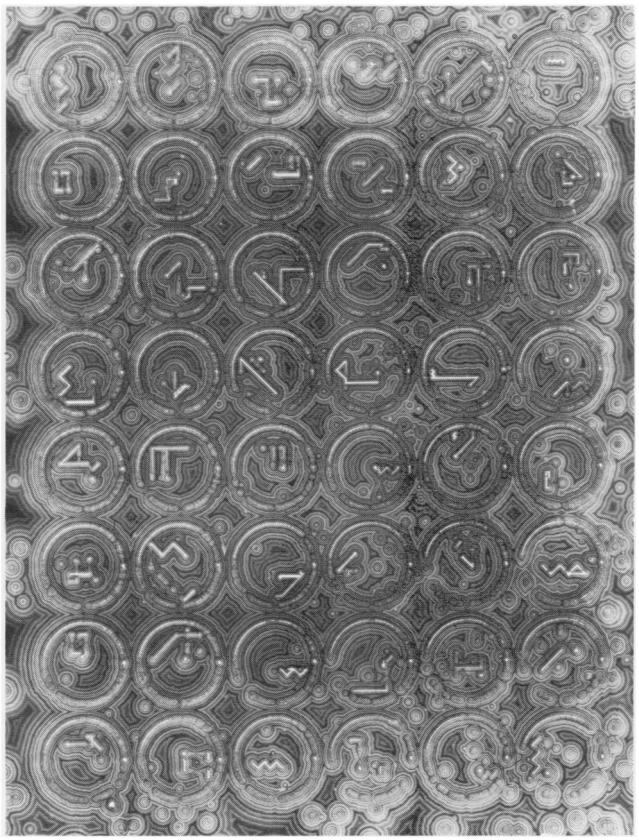

Fig. 10. 'Chemigram 21/4/72 II', computer engraving made by Manfred Mohr (Program 48, 1970), 16 × 12 cm.

may increase the value of the original, it hampers its diffusion. Thus, rather than mass-produce chemigrams, I have turned to various techniques of reproduction: color slides for projection, films, video, offset, dye-transfer, carbon print, Cibachrome, etc. Although such reproductions unavoidably lead to a loss in quality, they do, however, allow me to isolate and enhance by enlarging the details of certain chemigrams.

XI. GOALS

I'll not go into the deep-seated reasons for which I prefer making chemigrams rather than something else. But I list here eight main reasons that outline my goals.

From a technical point of view: (1) Uniting different graphic techniques. I have never had traditional training, either technical or artistic, and do not belong to any particular group of image-makers. This simplifies but also complicates my task. Photographers feel that I imitate painters and painters cast me as a photographer. Luckily, more and more, the borderlines between different artistic disciplines are being crossed [20]. Someone once said that labels were good for sticking on luggage; as for me, I dream of open workshops where creators could freely choose their techniques according to their inspiration. (2) Bringing new techniques to photography. This is to give the possibility to free ourselves from the technicality and the automatic workings of modern photography. (3) Methodically studying the possibilities of the chemigram technique.

From a creative point of view: (4) Using the creative resource of chance (Section V). (5) Exploring the ambiguous area that

separates the figurative from the non-figurative, seeking 'differential thresholds' (in photo-chemigrams) (Fig. 4). (6) Preserving the characteristic registration of localizing materials. Each material has its own characteristic way of registering. Thus, one can make the chemigram of a product as one can make a 'photogram' of an object or a 'photograph' of a person. (7) Transforming images (photos, drawings, paintings) to give them another appearance (Section IX). (8) Inventing images. This is to let the chemigram technique—by its own means and with the intervention of chance—reveal to us 'pseudo-photographs' of unknown and unknowable beings or worlds (Section VI).

If chemigrams can now be appreciated, thanks to the pictorial revolutions of the 20th-century's first decades, they could very well have been invented in photography's early years; they are perhaps the last adventure with light-sensitive silver emulsions. Soon, other techniques such as holography will take over. In 1972, in collaboration with Manfred Mohr, a German artist living in New York, I had my chemigrams engraved by a computer (Fig. 10). I am now looking forward to the day when I will be able to devise some kind of machine that would program the various conditions involved in the making of chemigrams: temperature, agitation, dilution, duration, etc. Pierre Schaeffer once told his students: 'One must not look back; to see Eurydice is to lose her'.

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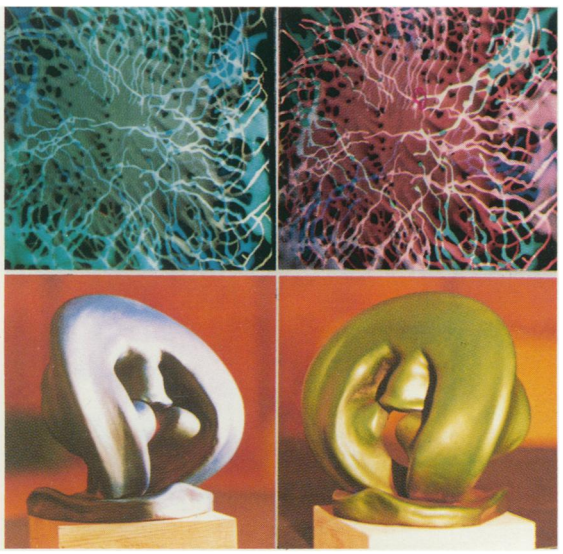
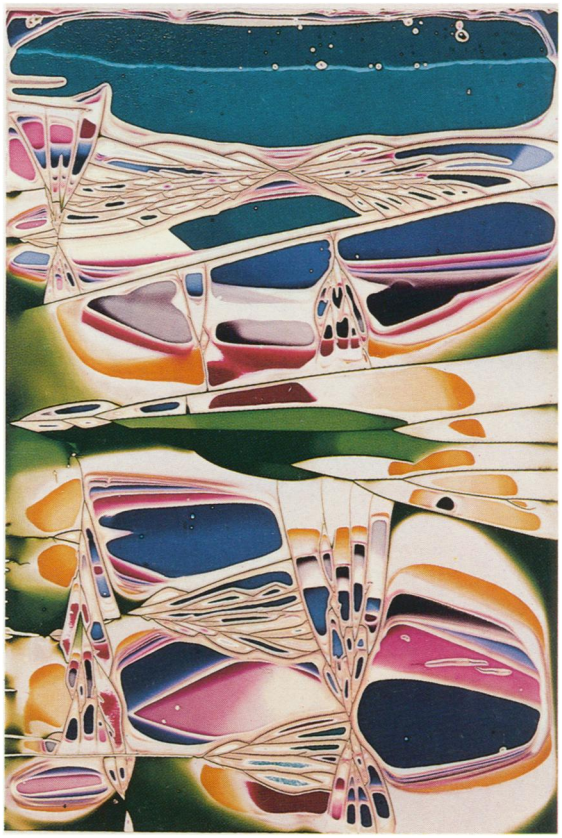
[**Editor's note**—Photograms have been discussed in *Leonardo* by David Haberstitch, Photography and the Plastic Arts, **6,** 113 (1973); Alan W. Bernheimer, Reflectographs: Nonfigurative Artworks Made Using Photographic Materials, **11,** 177 (1978); Arno Mandello, On My Non-Figurative Drawings on Photosensitized Paper and Acrylic Paintings, **11,** 210 (1978).]





No. 1. Top left. *David Makow. (Top) 'Roots', liquid crystals on plastic board, 60 × 60 cm, 1980: (top left) seen from left, (top right) seen from right. (Bottom) 'Flower', terracotta coated with liquid crystals, 25 × 25 × 25 cm, 1974: (bottom left) seen from left, (bottom right) seen from right.* (See page 260)

No. 2. Top right. *Pierre Cordier. 'Chemigram 31/5/70', detail C4, 8 × 5 cm.* (See page 264)

No. 3. Bottom left. *Marta Tanguma. 'Andromeda II', polyester resin, 10 × 2.4 m, 1981. Installed in Centro Bancomer, a subway station in Mexico City in 1982.* (See page 305)

No. 4. Bottom right. *Laser Affiliates and L.A.S.E.R. 'Water Dance' from 'Song of Ages' (Photo: J. Milton)* (See page 296)