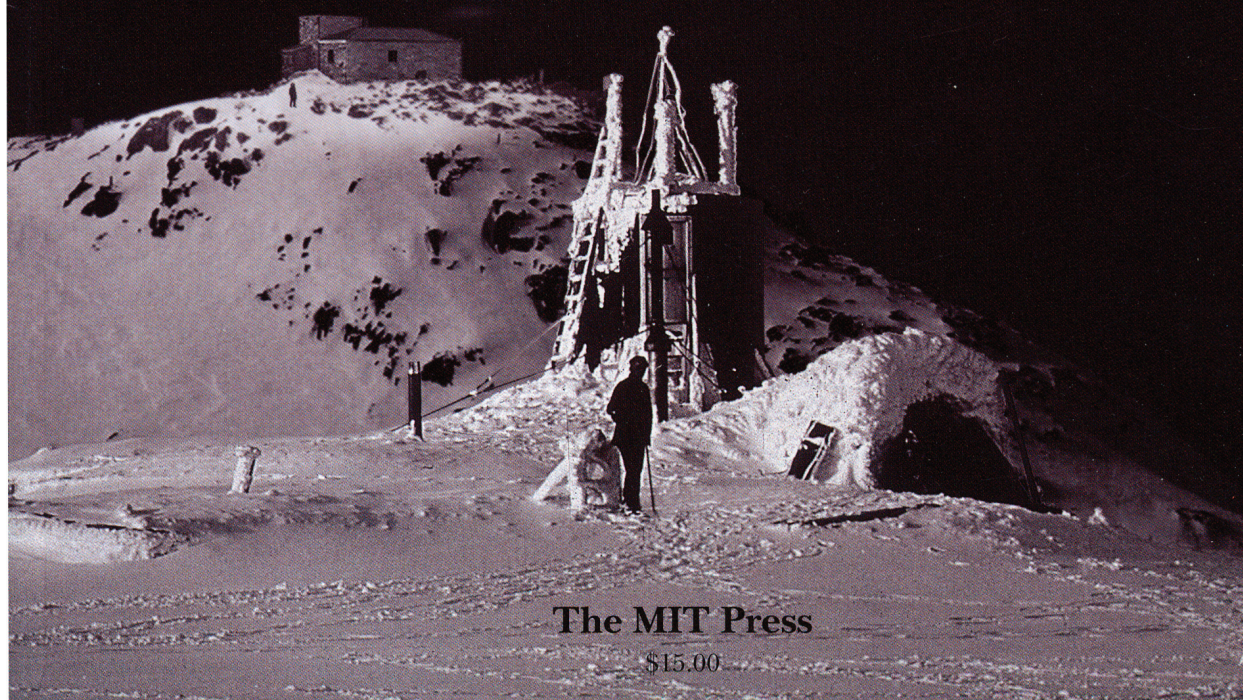


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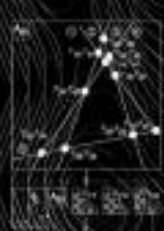


$P_{\text{config}}$  is an arrangement of intersecting lines  
 for number of lines connecting in a given direction.  
 $P_{\text{config}} \in \mathbb{N}_0$  a non-negative integer number.  
 There is a family of  $g$  maps in range from  $g=1$  to  $g=2$ .  
 $g=1$  is the number of the current configuration.  
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# An Artist's Journey in Art and Science: From behind the Iron Curtain to Present-Day America

*Sherban Epuré*

In 1973, the art critic Jacques Lonchamp, while traveling in Romania, visited my studio in Bucharest. I was preparing works for the Sigma 9 Festival in Bordeaux [1] (Fig. 1). We spoke at length about modern art. Before leaving, he said: "You should get in touch with *Leonardo* magazine; they specialize in topics relating to art and science," and went on to give me a contact name: Frank Malina. He was unaware that, in Romania, any contact whatsoever with the West, unless previously authorized and supervised by the Secret Service, was regarded with great suspicion. The regime was obsessed with cases of "foreign espionage" and "enemies of the people."

By Soviet decree, all art as it had been known to date had come to a halt by 1948. It was to be replaced by "socialist realism," a gross propagandistic/realistic art form uncontaminated by "capitalist degenerate art" that could be grasped by the entire working class and the political goal of which was to "create a new type of man" and "reeducate" all others. The masses did the thinking; the individual was to follow. Many books that had been published before the war were confiscated and banned. Citizens had personal dossiers that gave high grades to those with "good social origins," that is, those trusted by the

regime, and low grades to everyone else. This was the standard for judging every aspect of life.

It happened that my dossier fell into the bad category.

After high school I studied electronics. While working toward my degree, however, I was also making my first attempts at oil painting. Although I ended up in the research lab of a semiconductor factory, the highest position I could aspire to given my unfavorable dossier, it soon became clear to me that under such conditions, electronics could not become a fulfilling creative profession. By 1961, art, with its superior possibilities of creative freedom, had taken over my life. While continuing to make a living in electronics, I began to invest most of my time and energy in painting and the study of art history, eventually combining natural aptitudes for both art and science.

Although my great love has always remained plane geometry, I became fluent in many other disciplines. Within each of them is a special kind of beauty; problems can be solved in elegant ways that leave the practitioner with a sense of wonder related to nothing concrete per se, simply wonder itself, or the sense of gratuitousness that can be found only in the arts. Moreover, most of the operations occur in the independent, immaterial space in which thinking takes place.

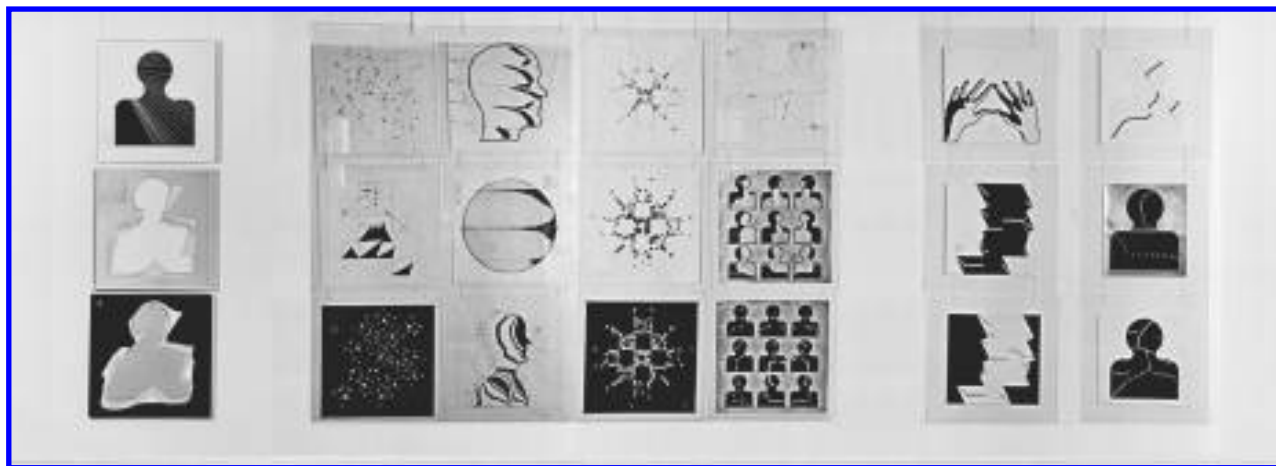
## ABSTRACT

The artist traces his work from its beginnings behind the Iron Curtain in 1967, when cybernetics became the driving force of his creative process, to the present day. Given the scarcity of information and the absence of access to Western experimental work in Romania, this step was the unlikely result of a purely personal train of thought. He went on to lecture and write extensively to promote cybernetics and explain his approach to art, which was highly unconventional in the context of the times. Two directions emerged and remain the focus of his work today: the S-Band, an interactive art machine, and the Meta-Phorm, a behavioral geometry articulated by cybernetic mechanisms.

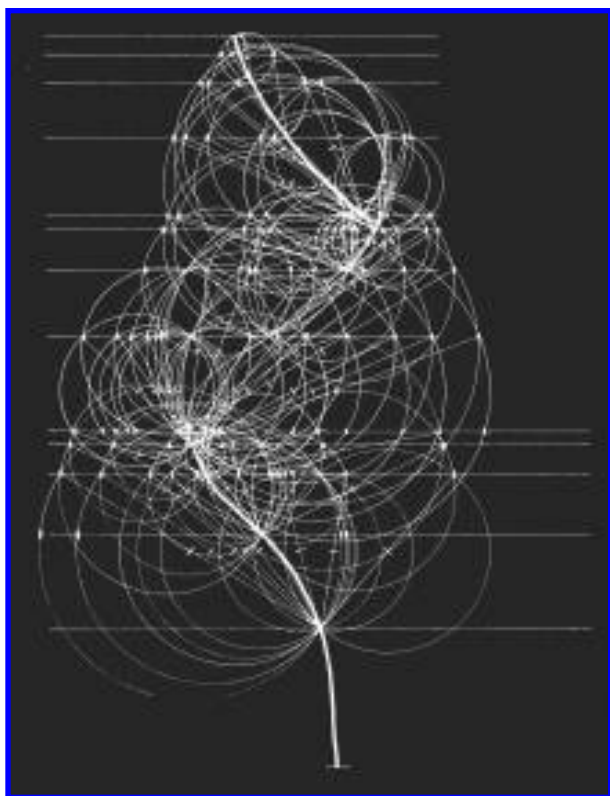
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**Article Frontispiece.** *Cybernetic Ceremony in Velvet Black* (Sigg06-BDA), inkjet, various sizes from 8.5 × 11 in to 125 × 160 in, 21.5 × 28 cm to 315 × 405 cm, 2006. (© Sherban Epuré)

**Fig. 1.** *Fine Arts and Cybernetics*, installation with Meta-Phorms, mixed media, various sizes; Sigma9 Festival, Bordeaux, France, 1973; the 3rd fine Art Competition, Platres, Cyprus, 1973; the New Gallery, Bucharest, Romania, 1974. (© Sherban Epuré) Artist's collection.







**Fig. 2. *Tree*, ink, 11 × 17, 28 × 43 cm, 1974. (© Sherban Epuré) A Meta-Phorm resulting from the interaction of a random flux of stimuli and a generic curve. Artist's collection.**

I was privileged to be encouraged at the start by C.C. "Tică" Constantinescu and Henri "Togo" Catargi, two great Romanian painters in the entourage of Matisse, Pallady, Fujita and Dufy.

In 1962, while still in the research lab, I had the opportunity to observe screens displaying output curves while measuring electronic devices. The electronic spot, like a bright star, was drawing lively, elegant curves on the darkness of the screen. It was then that I conceived of drawing my own forms with digital devices.

Two years later, I resigned my position and went to paint full time in the Apple Meadow Village at the foothills of the Carpathian Mountains, a place of indescribable beauty. The paintings I produced apparently had some merit, for they gained me admission to the Alliance of Fine Artists.

It soon became clear to me, however, that art must reflect vast new areas of knowledge and experience. The world had already entered the era of mass communications, the moon had been visited and robots and computers were in the works.

A short-lived period of liberalization starting in 1966 introduced a stream of new books and information to the underground. For the first time we had access to books containing the works of great contemporary masters. On becoming initiated into developments in art

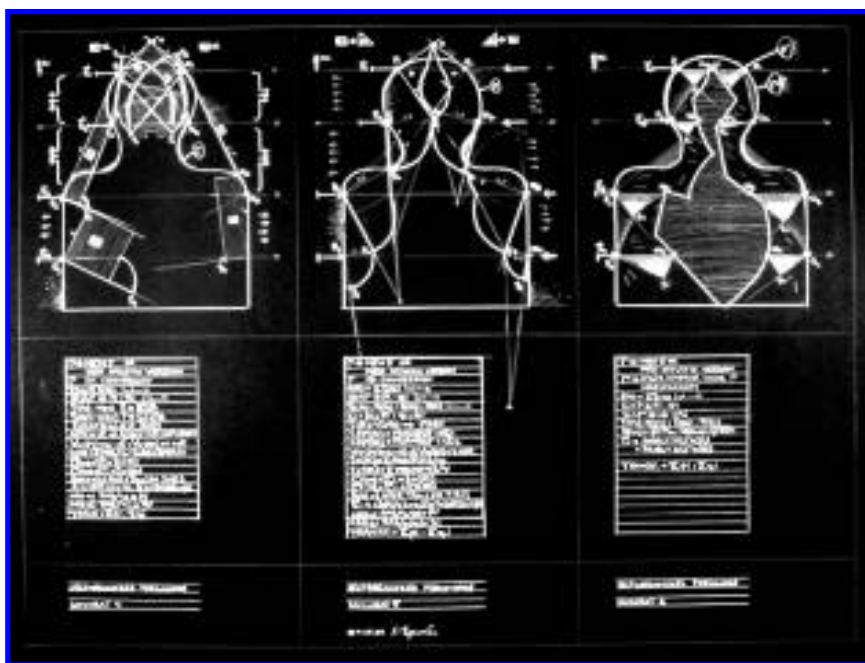
and science in the free world, a small underground of individuals immediately started writing, promoting and experimenting in their fields of expertise. These included, in mathematics, G. Moisil, Solomon Marcus and their students; in electronics, Edmond Nicolau [2]; in literature, Toma Pavel and Adrian Rogoz; in philosophy, Victor Mashek; in philos-

ophy, aesthetics and computer graphics, Mihai Nadin [3]; in music, Aurel Stroe and Lucian Metzianu. Cybernetics, information theory, structuralism, mathematical games, etc. became current topics in various intellectual milieus. In the fine arts world, otherwise characterized by traditional oil painting and works strait-jacketed by socialist propaganda, an exception was the flourishing center of Timisoara, where artists such as Ștefan Bertalan, Roman Cotoșman, Constantin Flondor, Paul Neagu and Diet Sayler, not to mention, in Bucharest, Ion Bitzan, Andrei Cădere, Ion Grigorescu, Mihai Olosz and Illie Pavel, were engaged in innovative experiments in constructivism, concrete art, structuralism, land art, conceptualism, serialism and kinetic art. Adina Caloenescu dedicated herself to cybernetics.

In 1966 I entered a period of multidisciplinary studies in many areas apparently unrelated to art [4–22]: information theory, cybernetics, structuralism and constructivism as an unfolding mathematical game. I was fascinated by dynamic natural processes [23]. Such processes convey information and involve actions, reactions, changes of state and behaviors. In short, I had unwittingly stumbled upon cybernetics and felt compelled to make it the driving force of my creative process.

From the start, I made a distinction between computer art and cybernetic art. It seemed to me that the first type of art was completely computer dependent,

**Fig. 3. *Personae* (db21), gouache, 20 × 26 in, 50 × 65 cm, 1983. (© Sherban Epuré) Meta-Phorms; interactions of a random flux of stimuli with a domain with human shape using three different methods. Artist's collection.**



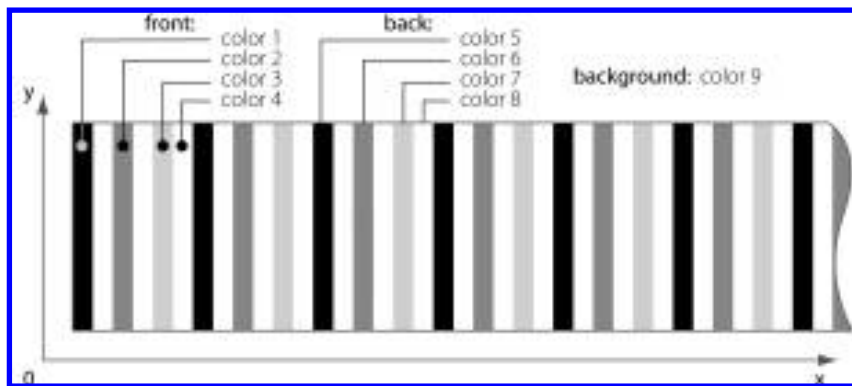


Fig. 4. *S-Band*, generic master with vertical stripes, hand-printed paper, 4 × 27 in, 10 × 70cm, 1968. (© Sherban Epuré) Artist's collection.

whereas the second, being more a way of looking at how things relate to each other, was subject to experimentation in a variety of media and with various tools. No longer machine dependent, my imagination could invent all sorts of graphic scenarios to be expressed in mathematical statements. Mathematical statements, however (the Pythagorean theorem, for example), are, by their very nature, simultaneously computer free and computer compliant. With this strategy I was able to pursue experiments even when specialized tools were not available. When needed, my mind was the computer and my hand the plotter (Fig. 2).

Concurrently, I began to lecture and write at every opportunity to promote cybernetics and explain these new experiments in art so at odds with the context of the period. I never doubted that computer art represented a legitimate and unexplored territory with a brilliant future.

By the end of 1967, two directions had emerged; these remain the chief focus of my work to this day: the *S-Band* and the *Meta-Phorm*.

Both types of work were shown in several venues [24–29] between 1969 and 1978. At the Sigma 9 Contact II in Bor-

deaux, France (1973), I would have had an ideal opportunity to meet firsthand some of the most influential artists and animators in the field of computer art, such as Georges Charbonnier, Abraham Moles, Herbert Franke, Herve Huitric, Peter Kreiss, Kenneth Knowlton, Vera Molnar, Manfred Mohr and Georg Nees (I would get in touch with the latter in 1995 [30]). However, as on all other such occasions, I was denied a passport.

Beginning in 1976, Romania slowly entered one of its darkest periods, a time in which terror, poverty and draconian restrictions obtained. Of course, my experiments ceased even to be tolerated, and I was completely marginalized. As an artist couple, my wife, Letizia Bucur, and I faced a dilemma: We had either to abandon art or attempt to safeguard our careers. In 1977 we decided to emigrate to the U.S.A. It was not until 1980 that we succeeded, after many harrowing developments, in acquiring passports and leaving for New York. We left behind most of our artwork. We did not experience the cultural shock we had been warned about, but the problems of making a living while continuing to paint were almost overwhelming.

In 1985 I made the Macintosh my tool of choice. It was only in 2000–2005, however, that the technologies resulting in fast computers, scanners, digital cameras, camcorders, professional printers, CDs, DVDs, archival papers and inks, and consistent color calibration came on-line as the affordable realities I had anticipated since the late 1960s. In the meantime, I had continued to prepare computer-compliant projects to have ready against the day when realizing them would become possible (Fig. 3).

Of course I ventured into programming, especially Lingo and Action Script. However, weighing the time required for learning and becoming fluent in the codes against my expectations and the results obtained, I decided to stick with the

method I had already developed, relying on code-memorized thinking, which had already proven to be conveniently fast and efficient, albeit highly personal.

The decades 1980–2000 may be fairly described by the word seclusion. Eventually, I started to show my work again in venues dedicated to digital art. The New York Digital Salon, in particular, proved a very welcoming art family as early as 1995.

## THE S-BAND

The *S-Band* (Sherban's Band) is a "long," bidimensional material structure, carrying colored stripes on either of its sides and with random geometrical parameters (Fig. 4).

the band reconfigures 12 visual variables, three of geometry and nine of color. In the end the *S-Band* is a two- and/or three-dimensional painted sculpture. The result is a large family of nonsubjective [31] art alternatives. The underlying idea is that the latest configuration obtained stimulates the viewer's curiosity and encourages the viewer to find a new one. I view this as an interactive situation. The purpose of the band is not to imitate nature, as origami does, but to produce nonsubjective, enjoyable art forms. Its ability to reconfigure both geometrical and visual attributes ensures its independent identity. *S-Bands* exist in three subsequent generations of forms: those produced manually (Fig. 5); computer explored (Fig. 6); and combined in two and three dimensions (Fig. 7). The computer generation lends itself to the use of the Birckhoff formula [32], which aids in the optimization of aesthetic quality by adjusting the complexity.

## THE META-PHORM

The *Meta-Phorm* (derived from *meta* + *metaphor* + *form*) is intended to be the visual appearance of an abstract creative



Fig. 5. *S-Band* (sb2605a2), hand-printed paper, 6.5 × 7.5 in, 16.5 × 19 cm, and larger sizes; first generation hand-manipulated, 1969. (© Sherban Epuré) Artist's collection.



Fig. 6. *S-Band* (sb2605a2Bh16), 6.5 × 7.5 in, 16.5 × 19 cm, and larger sizes, inkjet, 2005; second-generation computer experiment of the *S-Band* in Fig. 5. (© Sherban Epuré) Artist's collection.

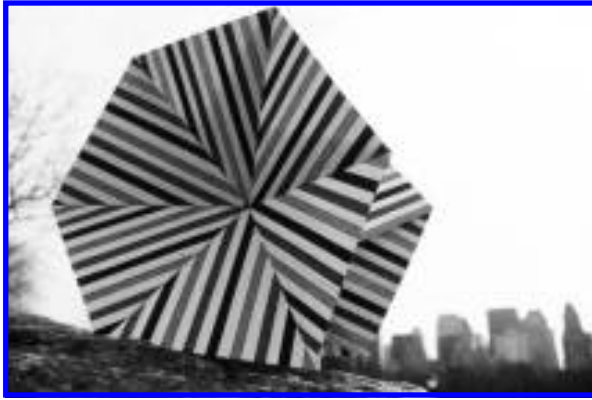


Fig. 7. *S-Band*, maquette for a  $20 \times 120 \times 10$  ft ( $6 \times 6 \times 3$  m) project, 1971. (© Sherban Epuré)

proposition (transposition of an idea into matter) by introducing geometrical forms into a game relationship that emulates the cybernetics model.

In my school years I was struck by the fact that a student, in attempting to solve any given mathematical problem with chalk on a blackboard, unwittingly ends up making a painting of sorts. In 1967, it occurred to me that I might make the process art specific: in other words, find a kind of geometry dedicated to art. Such a geometry might then become the starting theme for my work.

As I soon found, this idea had already been tackled from many directions by others [33]. My approach, however, is intended to realize the final image/object by emulating cybernetics.

The first step was to formulate a set of conventions/axioms specific to my working universe, the most important being that a geometric form on a sheet of paper symbolizes an entity endowed with life ready to participate in a game through combination and interaction, in the same way that a child imbues her doll with life or a chess player puts himself in the shoes of the missing partner.

For me, commands of the type “go there, do this,” and statements such as “a specific point  $P$  is impervious to stimulation,” or “the behavior of point  $P$  will be a geometrical domain expressed by a certain drawing” are all legitimate. In my working space a point is a black box defined by its geometrical coordinates/location and a given behavior. The latter, conceived as an algorithm, may be written or embedded in the artist’s thinking. It is the nexus in which an input may trigger an output or behavior. All locations in the working space where such behavioral black boxes are positioned are called Meta-Points. Otherwise, any point that is merely a feature of conventional geometry will be considered static. Consequently a curve, a domain or a point population will constitute an ensemble of Meta-Points with similar output mani-

festations, if and when triggered, located in space according to a given law or equation. Such ensembles may translate into organized or random collections of points, lines, polygons, general curves, etc., regardless of complexity. They are expected to behave like live entities in ways specified by the artist and will function as participants in the further buildup of a Meta-Phorm (Fig. 8).

The process of building a Meta-Phorm is essentially a game, but it is designed not to score points or pinpoint a target, but to elaborate an artistic image. Its rules are stated in mathematical form with appropriate symbols of the artist’s choice (in order to clarify, impose order, establish consistency and memory). Therefore the game develops through the behavior of its counters (geometric shapes, as defined above), proceeding in overlapping layers or steps, and may best be perceived as a storyboard or animated sequence, although each intermediate phase provides an image of considerable aesthetic value and potential of its own.

Since I have placed my activity in the realm of art, the above need not neces-

sarily comply with mathematics or physics, although I find these are of great inspiration and often use them.

The work unfolds according to the following scenario:

**The players** in this visual game, together with their roles, are defined.

**A theme** is proposed by asking an abstract question: What image will result from the implementation of a certain method?

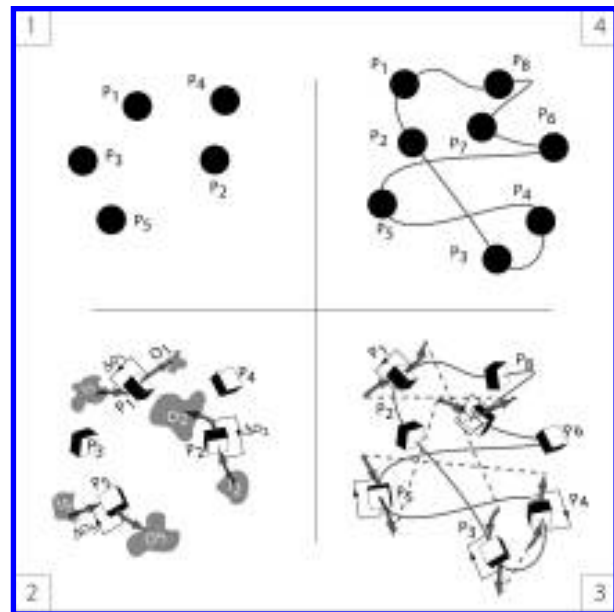
**The method** is selected to establish rules whereby the theme, idea or creative inspiration becomes an image/object and is materially realized (usually via a drawing). At the start, there is a concept that is fully active and visually a cipher; when the process is exhausted, the concept is fully visualized and the immaterial has been translated into matter. The immaterial becomes material, a visual “nothing” becomes “something.” It can be said that the process itself infuses originality into the work. Indeed originality [34] is at its highest point when the visual information is at its maximum. In my work this happens when the image reveals itself as an unforeseen surprise. The latter inspires further inspiration and may trigger intuition. Figure 9 is an example.

**The players:** Take a domain  $D$ , divided by any number of free/random curves, which results in any number of uneven cells. Let us also consider inserting a Meta-Point somewhere into the domain (Fig. 9-1).

**The theme** takes the form of a question or proposition: What image will result from the interaction between the point and the field?

**The method:** Suppose that, falling somewhere inside the field, the point

Fig. 8. Meta-Points. (© Sherban Epuré)  
(1) Points symbolized in conventional geometry.  
(2) Meta-Points in place of the points in (1).  
(3) A curve made of points in conventional geometry.  
(4) The curve in (3) made out of Meta-Points.





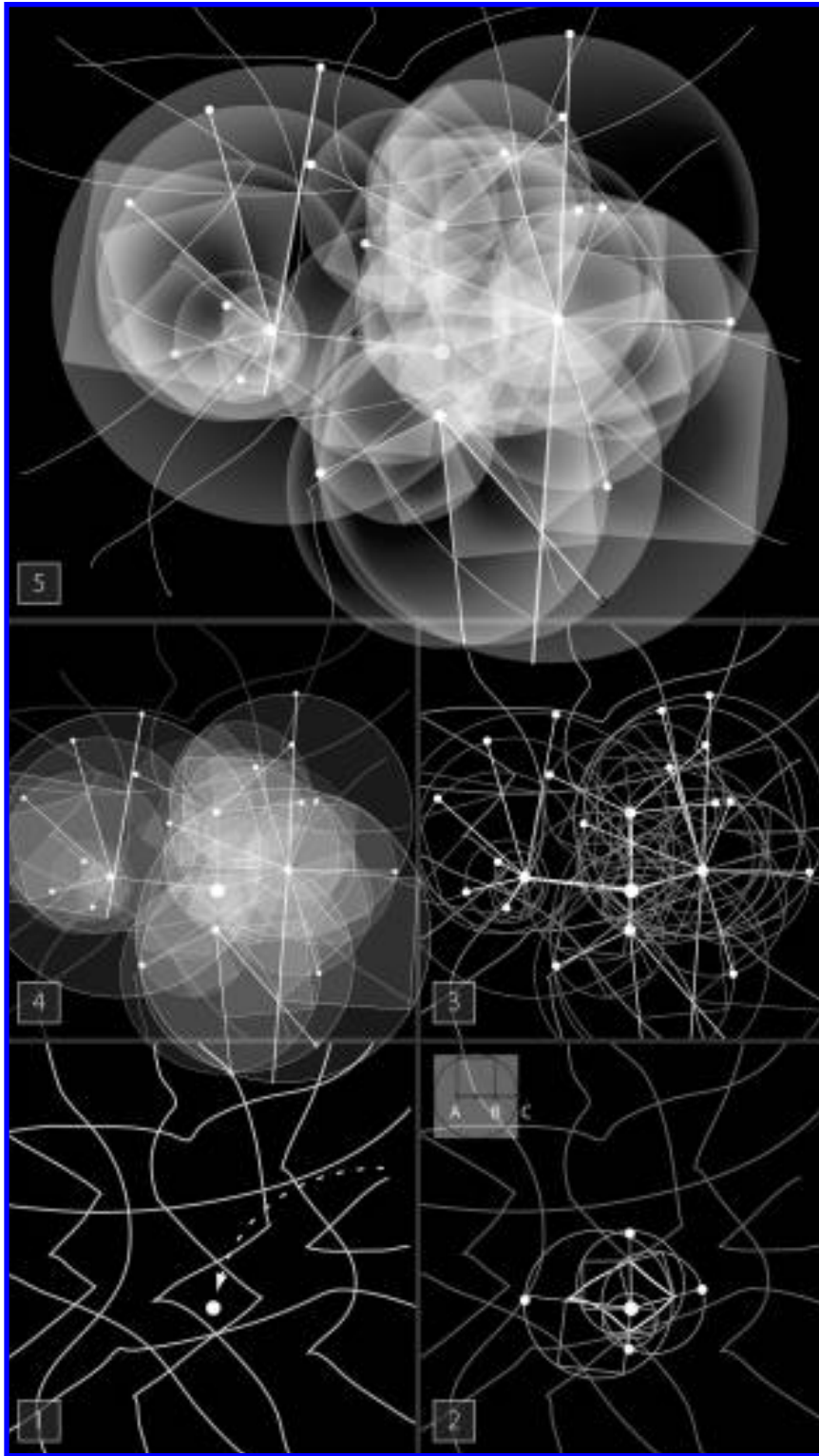


Fig. 9. *Population of points* as the outcome of the interaction between a point and a geometric domain. (© Sherban Epuré) (1) In this particular case, the domain/field is divided by random curves into irregular cells and the points fall somewhere in one of them. (2) The first generation of offspring and (3) the second. The parameters that decide the size of the population are the randomness of the points' positions and the number and position of the cells' vertices. (4) and (5) show graphic solutions that improve clarity and visual expression.

finds itself inside one of the cells. After scanning the environment it detects a vertex of the cell and connects itself to it. It will then duplicate itself alongside the connecting line so that the distance to the offspring is in a given proportion to

the distance to the vertex. In Fig. 9-2 the proportion is the golden mean (Fibonacci number = 1.618).

The process will be continued through as many generations as necessary for the image to remain artistic (Fig. 9-3).

**The Result:** The point leaves a graphic trace of its life in relation to its environment in the form of curves and other geometrical shapes. We will consider the intended final artistic image to be the visual totality of all geometric elements participating in the development of the process. Such a totality may consist of the entire visual complex, its evolution as an animated sequence, a storyboard or the static images of the individual layers (Fig. 9-4 and 9-5).

To consider another example (Fig. 10):

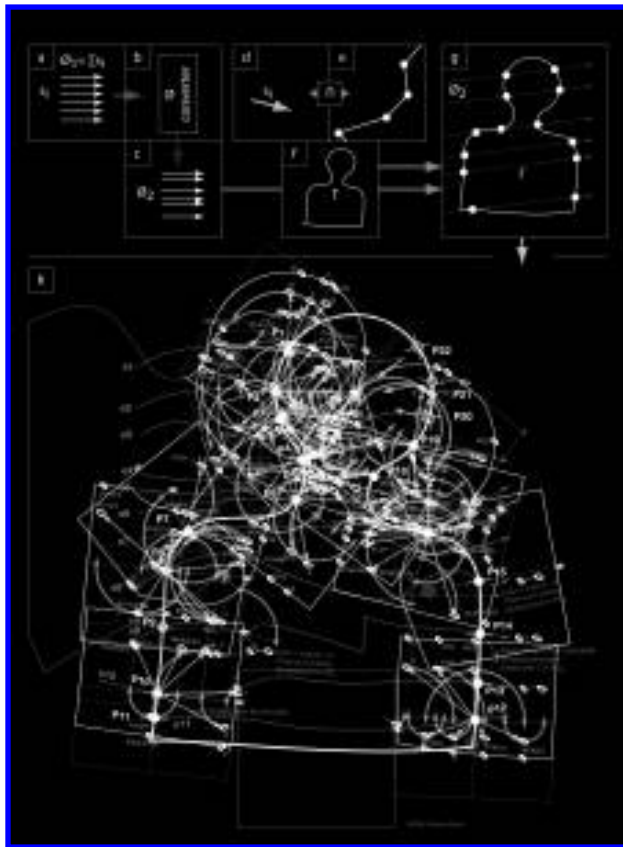
Here, the Meta-Phorm is the end product of the interaction between six others in a three-level process. First, the constant frequency of a flux of stimuli/vectors (Fig. 10a) is randomized (Fig. 10c) by a geometrical "frequency converter" (Fig. 10b). Next, another system, made of only one object, a vector/stimuli (Fig. 10d), interacts with a chain of segments (Fig. 10e) and produces the domain (Fig. 10f). Finally, the interaction of the domain with the random flux of stimuli (Fig. 10g) produces the final Meta-Phorm (Fig. 10h). The latter will be a major part of the final artwork (Article Frontispiece).

**Aesthetic assessment.** The Meta-Phorm, as a complex, is continually gauged against aesthetic considerations to ensure visual expressiveness and efficiency. Meanwhile, the only way to consider color at this stage and avoid kitsch is to identify and emphasize symbols and operations.

So far, the resulting artistic image is a linear drawing. In the next stage it will reach its final status as an independent composition.

### SUBJECTIVITY, NONSUBJECTIVITY, COLLECTIVE EXPERIENCE

This process entrusts the Meta-Phorm (in Fig. 10h for instance) to the nonsubjective mathematical operations buried deep in the many features of software-hardware specialized in digitally analyzing and handling images. These trace in/reduce/recognize/extract mathematical and electronic attributes from the image and use them to shift, reorganize and transform it (subjectively assisted by the artist [35]). This is what I think of as *mutation of content*. Connected as a mathematical continuum of numbers and formulas, the palette of colors, their shape and the surfaces they occupy are handled simultaneously, resulting in a consistent and unified totality that resurfaces in a completely unexpected non-subjective composition of entirely new visual signs (Fig. 11). The many multi-



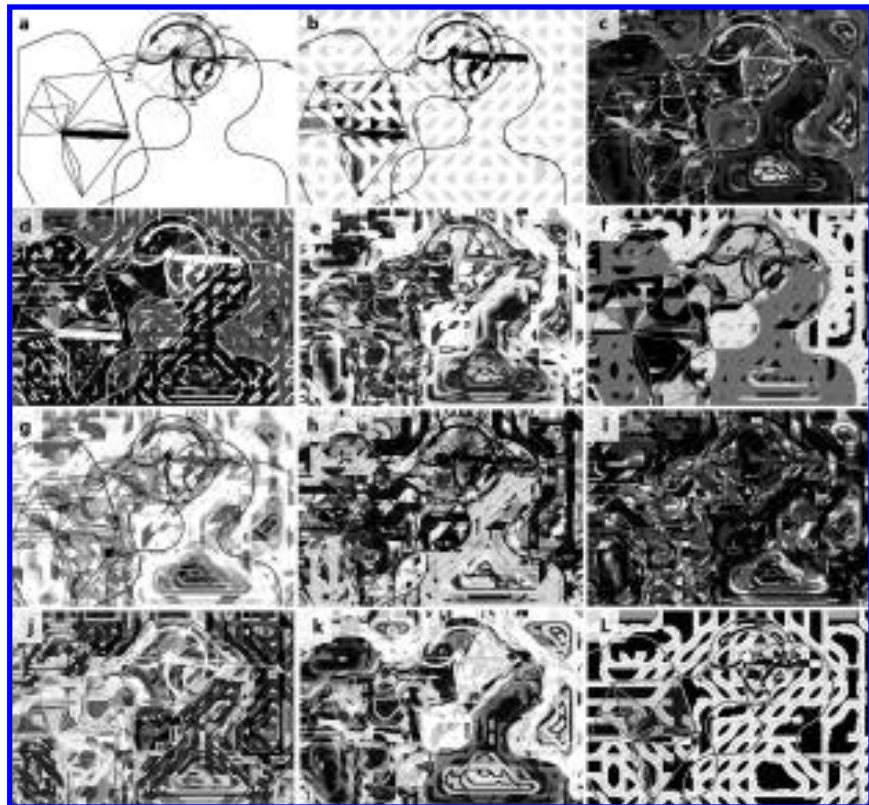
**Fig. 10. *Persona*, master (Sigg06-C4). (© Sherban Epuré)**  
 (a) The constant frequency of a flux of stimuli is randomized in (c) by the frequency converter in (b). A generic human shape seen as a particular case of a general geometric domain in (f) results when a one-stimulus input system (d) interacts with a polygon (e). In (g) the random flux of stimuli in (c) interacts with the shape in (f) and produces the *Persona* in (h). Each of these interactions proceeds from specific algorithms.

layered mathematical operations are carried out exclusively inside the “secrecy” of the software, which in turn waits on frequent aesthetic decisions from the artist [36]. Figure 11 and Color Plate D show such compositions selected from a large body of alternatives, devoted only to the operations that took place in point  $P_1$ /Step1 of the Meta-Phorm in Fig. 10h. The originating Meta-Phorm (Fig. 11a), while remaining embedded and recognizable, melts inside an unexpected composition that grows out of it, non-subjectively produced but subjectively selected, and becomes the major feature of the work (Fig. 11b–11l). This is an overriding metaphor for the coexistence of the creative impulse embedded in its self-created form. At this point the process produces, for the second time, surprise and originality, which trigger a new category of creative ideas.

The work becomes a dual process, a continuous give and take between the artist and a segment of collective technological experience at large, holographically embedded in the software-hardware. The latter takes over the operations entrusted to it until it is incapacitated by the absence of discriminative decisions required to evaluate the results and not found in the exhausted algorithms. At this point the artist is called on to reclaim his supervising authority inasmuch as the computer lacks

intuition and has no opinions. Here we have a mediation between subjective and nonsubjective actions.

**Fig. 11. *Compositions with Meta-Phorms*, samples (2706MontajB&W). (© Sherban Epuré)**  
 (a) Shows the operations devoted to the developments in  $P_1$ , Fig. 10h. (b)–(l) show the production of new visual content from (a). Everything that is not in it derives from it.



This conclusion calls for some comment on the idea of mediated subjectivity.

For some, art seems to start as a personal inclination, the need to express and convey something. For others, it is a response to social demands in the modern industrial context of communication, consumption, efficiency, etc. The first attitude is permeated by subjectivity. A nonsubjective approach is more suitable to the second, which answers to the needs of many and is, therefore, mostly impersonal.

In the process described above, both attitudes are joined. The subjective attitude to art is entrusted to a rigorous objective intermediary (mathematics, computers), which, after processing, returns the result as a family of alternatives ready for interpretation (Fig. 11). This, however, requires again the use of a personal, “global” cultural assessment. From this perspective, there are two partners in this process: the individual (artist) and the collective experience [37]. The latter, a consensus about things of broad interest, is elaborated by the sustained effort of many persons throughout the world. Such a collective experience can stretch across one or several generations, continuously measuring itself against the content of previous generations, and rep-



resents a flow of intelligence that establishes trends and pinpoints generally accepted opinions and practices. Computer sciences and technologies are regulated by such a “flowing” body of knowledge. Therefore, when one uses computers, one shares personal experience with the impersonal, anonymous collective experience contained in both software (knowledge) and hardware (technology) and reflecting the creative power and potential of the society at a given moment. One may become aware of the extent to which the “impersonal” is embedded in the “created” end product of such a body of knowledge (art, computers, technologies, etc.). To our surprise, however, the concept of *awareness of the impersonal in the created* may invite us to revisit definitions of spirituality, especially in the light of modern interpretations of Hindu philosophies [38]. At this point, however, our discussion breaks into new dimensions.

## References and Notes

1. The 9th Sigma Festival, Contact II, featuring artworks by Sture Johannesson, Peter Kreiss, Kenneth Knowlton, Herbert Franke, Herve Huitric, Vera Molnar, Manfred Mohr, Georg Nees, Jacques Palumbo. I participated with 11 gouaches, a 16-mm film of S-Bands and a paper at the colloquium “Creation Artificielle” chaired by Georges Charbonnier and Abraham Moles at the Gallery of Fine Arts, Bordeaux, France, 1973. Director: Roger Lafosse. See Georges Charbonnier, “L’ordinateur au service de l’Art,” *Connaissance des Arts*, No. 264 (1974) pp. 70–75.
2. Edmond Nicolau, *Introducere în cibernetică* (Bucharest, Romania: Editura Technica, 1969).
3. Mihai Nadin, *Elements of Meta-Aesthetics* (in Romanian) (Bucharest, Romania: Eminescu, 1972).
4. Jurgis Baltrusaitis, *Metamorfozele Goticului* (Bucharest, Romania: Meridiane, 1978).
5. Jean Baudrillard, “La Morale des Objets,” *Communication*, No. 13 (Paris: Seuil, 1969) pp. 23–50.
6. Albert Ducrocq, *Le roman de la Matière, Cybernétique et Univers* (Paris: Julliard, 1963).
7. Matila C. Ghyka, *Le Nombre d’Or* (Paris: Gallimard, 1931, 1959).
8. Rennais Huyghe, *L’histoire de l’Art Contemporaine* (Paris: librairie Felix Alcan, 1934).
9. Paul Klee, *Écrits sur l’art*, Vol. I, *La Pensée Créatrice*, and Vol. II, *Histoire naturelle in finie* (Stuttgart, Germany: Schwabe et Cie. Verlag; Paris: Dessain et Tolra, 1977–1980).
10. Henri van Lie, “Objets et Esthétique,” *Communication*, No. 13 (Paris: Seuil, 1969).
11. Jean Piaget, *Le Structuralisme* (Paris: Presses Universitaires de France, 1968).
12. Abraham A. Moles, “Théorie de la complexité et civilisation industrielle,” *Communication*, No. 13 (Paris: Seuil, 1969).
13. Abraham A. Moles and E. Wahl, “Kitsch et objets,” *Communication*, No. 13 (Paris: Seuil, 1969) pp. 105–129.
14. Nadin [3].
15. Nicolau [2].
16. Max Bense, “Einführung in die Informations-ästhetik,” in *Kunst und Kybernetik. Ein Bericht über drei Kunsterziehungsversuche* (Recklinghausen, Germany: 1965, 1960, 1967).
17. Max Bill: “The aim of Concrete art is to create ‘in a visible and tangible form things which did not previously exist... to represent abstract thoughts in a sensuous and tangible form.’” Tate Online/Glossary/Concrete Art, <www.tate.org.uk/collections/glossary/definition.jsp?entryId=74>.
18. Rul Gunzenhäuser, “Ästhetische Mass Birkhoffs in Informationsästhetischen Sicht,” in *Kunst und Kybernetik* [16].
19. Frieder Nake, “Ästhetik der Informationsverarbeitung” (1974).
20. Georg Nees, “Geometry and the Cognitive Principle in Semiotics and Aesthetics,” *Semiosis* (1977/1978–1995).
21. Georg Nees, “Regency Graphics and the Esthetics Laboratory: Picture Generation by Point-Distinction and Pseudodistance-Minimizing,” *Leonardo* 23, No. 4, 355–361 (1990).
22. Harold Rieder, “Einführung in die Informationspsychologie,” in *Kunst und Kybernetik* [16].
23. By dynamic processes I mean processes that allow a system to adapt to conditions otherwise unknown to it.
24. The 25th Edinburgh International Jubilee Festival, the Richard Demarco Gallery, Edinburgh, Scotland, 1971.
25. Work (Meta-Phorm) awarded at the Third International Fine Art Competition, Platres, Cyprus, 1973.
26. The 8th Youth Biennial of Paris, invited by France (S-Bands, movie and installation), Museum of Modern Art of the City of Paris, France, 1973. Director: Georges Boudaille.
27. See Ref. [1].
28. Participation with S-Bands at the major *Romanian Modern Art* exhibition, Novi Sad, Yugoslavia, 1974.
29. Painting and Cybernetics, installation and extensive personal exhibition, papers and conferences, part of the Art and Energy exhibition, the New Gallery, Bucharest, Romania, 1974. Curated by Dan Haulica.
30. Excerpts from a 1996 letter from Georg Nees: “The material you sent me is that rich and important, that it has gotten an extra file in my private library. . . . The real surprise of course, is the copy of *Connaissance des Arts*, #264, février 1974, proving our companionship in exhibiting computer art. So you are a real pioneer of computer art!!! What I admire highly, is your ability to invent innovative canons of form. . . . So you have found yourself your personal language and writing of form, what is a rare event, I think. . . .”
31. Nonsubjective: Undistorted by emotion or personal bias, a connotation richer than that carried by the abstract or objective because it points to all four kinds of subjectivity related to art.
32.  $A = O/C$ —A stands for aesthetical value, O for order and C for complexity.
33. Bense [16]; Bill [17]; Gunzenhäuser [18]; Nake [19]; Nees [20,21]; Rieder [22].
34. Let  $O$  be originality,  $t$  time and  $I(t)$  the significance of the information. When the message is completely new, that is, it cannot be anticipated by the current status of education or culture and, in our example, is unforeseen the amount of conveyed information is at its fullest while the amount we assimilate is at its lowest point. By acquiring the set of notions by which we understand its significance, however,  $I(t)$  grows in time (varying from person to person and culture to culture). This can be formulated as follows:  $O(t) = (I_{conveyed} - I(t)_{assimilated}) / I_{conveyed}$ . As time  $t$  passes, the learned part of the message,  $I(t)_{assimilated}$ , increases while at the same time originality  $O(t)$  is diminished. When time reaches the moment  $t_i$  when nothing unfamiliar remains from the original message  $I(t_i)_{assimilated} = I_{conveyed}$ , the object becomes assimilated, understood and loses all originality:  $O(t_i) = 0$ .
35. **Subjective:** proceeding from or taking place in a person’s mind rather than drawn from the external world: personal, intuitive, subconscious. The most subjective element is the “fever of expression” each artist brings to the work. We may find subjectivity also in the narrative/literary subject, kitsch and the ways different people or cultures interpret an image. These are attributes foreign to the true specifics of the visual arts language and are arbitrarily infused/attached to it.
36. While constantly aware of modern investigations in aesthetics (see refs. [16–22]), I rely heavily on the fine arts’ findings, resulting from historical practice, as passed down to me by my two mentors, and which, in a nutshell, are: great sincerity of personal emotion (best explained by Matisse; see Jack Flam, *Matisse on Art* [Berkeley, CA: University of California Press, 1995–2004]), originality of concept, originality of technique, strong colors and “sonority” (a term extrapolated from music: having or producing a very full, deep, rich spectrum of resonant visual effects and high complexity).
37. Collective experience is not to be confounded with collective mind.
38. Paramahansa Hariharananda, *Kriya Yoga* (Homestead, FL: Kriya Yoga Institute, 1977–2006) introduction and pp. 1–23.

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