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Vladimir Bonačić
DIN. PR18
1969
Computer-controlled light installation
Metal construction, electronics, electric lamps, glass
18 × (48 × 88 × 25 cm), total length 30.80 m
Installed on Nama department store, Kvaternik Square, Zagreb
SDS-930, computer program implemented in special-purpose hardware
Produced at Ruđer Bošković Institute, Zagreb

Galerija suvremene umjetnosti, Zagreb
May 5 – August 30, 1969

Competition, *tendencije 4. kompjuteri i vizuelna istraživanja / tendencies 4. computers and visual research*

Vladimir Bonačić
Art as a Function of Subject, Cognition, and Time

Vladimir Bonačić studied electrical engineering at the University of Zagreb, as well as in London and Paris, and wrote his Ph.D. thesis on "Pseudo-slučajna transformacija podataka u asocijativnoj analizi kompjuterom" [Pseudo-random Data Transformation in Associative Analysis by Computer]. In November 1969 he became head of the Laboratory for Cybernetics at the Ruđer Bosković Institute.

The organizers of *tendencije 4* / *tendencies 4* probably first contacted the institute in early 1968. This developed into a collaboration between Bonačić and the artist Ivan Picelj in the same year. Together they realized Ivan Picelj's design for the poster for *tendencies 4* as a three-dimensional light object with the title *t4*. Bonačić also created a series of computer-generated images for the information exhibition that accompanied the colloquy "Kompjuteri i vizuelna istraživanja" / "Computers and Visual Research," which took place in August 1968. One year later, his new works, which had been created in the interim and handed in for the 1969 exhibition *kompjuteri i vizuelna istraživanja* / *computers and visual research*, received awards in the competition.

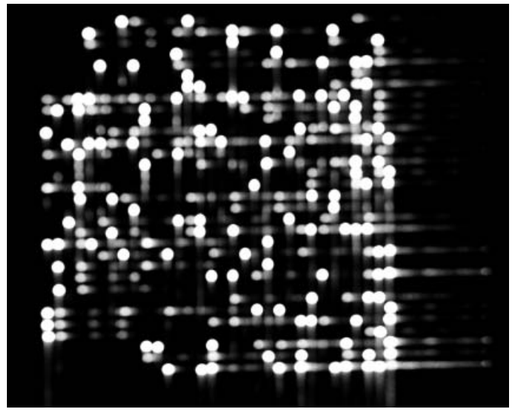
The text that is reprinted here in an abridged version was originally published in *bit international 7* where the following remark was added to the text: "Paper read at the symposium 'Kompjuteri i vizuelna istraživanja' / 'Computers and Visual Research.'" However, the text published in *bit international 7* differs greatly from the audio recording of Bonačić's presentation.

[Originally published as "Umjetnost kao funkcija subjekta, spoznaje i vremena" / "Art as Function of Subject, Cognition, and Time," in: *bit international 7*, Boris Kelemen and Radoslav Putar (eds.), Galerije grada Zagreba, Zagreb, 1971, pp. 129–142.]

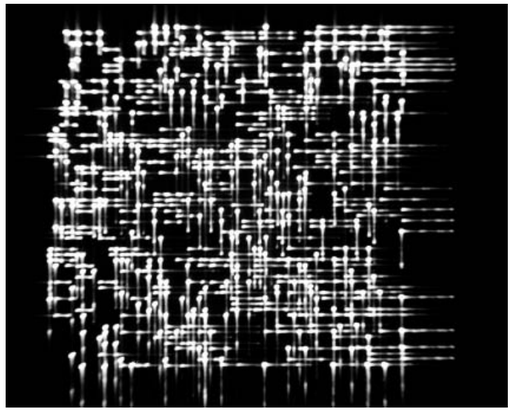
[...] One of the basic problems confronting human beings today is to make the world of science more communicable and accessible to the individual. Differentiation in fields of research is a consequence of both the inexhaustible variety of problems we solve and our biological limitations. To obtain greater insight into the ideas achieved by various branches of science (especially the natural sciences) nowadays requires a few years of study. Particular fields have their own specific methods and terminology, and their presentation in everyday language is almost always only a very rough approximation of the core of the problem.

In spite of the differentiation among scientific disciplines, there are common features in the various fields. To most people, these basic features remain hidden, even the less specific problems or the methodology of other fields of research.

Present-day mathematical methods, as well as our way of thinking, have become inadequate for solving new scientific problems. The scientist looks for new potentialities. The solution of many a problem is almost impossible without the aid of a computer. Heuristic programming, which is the method a human being would use in solving a problem, is applied to the computer. We start from the hypothesis and possible solutions that have to be checked, before we proceed with trial and error. The solution is in fact the confirmation of the hypothesis, but heuristic programming does not promise it a priori. This method of identifying patterns also plays an important part in the solution of a problem. New and quite unpredictable structures obtained through computers reveal the essence of the process. One discovers unknown logic and laws, and results unobtainable through classical mathematical analysis appear. Transforming the structures within various coordinate systems and time, we find out the determination which gives us a more complete picture of the observed process. The structures in figures 1 and 2 (elements of the pictures *PLN 5* and *PLN 6*), which are completely unexpected and which cannot be distinguished by traditional mathematical methods, are presented. These pictures show periods connected with the initial stage 1 and polynomials of the eighth degree in feedback.



1

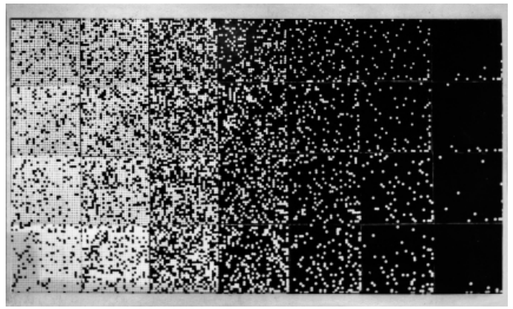


2

In figure 3, an element of the picture *IR. PLNS. 0044. 7714. 7554. 7744* (also *IR. PLNS – 3. V. B.*), we can see the structural differences in time when generating the maximum period of irreducible polynomials of tenth degree in feedback (divider) and the initial stage 1.

New expressive potentialities in communication with the individual were sought. The logical process becomes a function of time. Thus, besides the basic structure of the aesthetic objects, we notice their relations, obtaining more complete information on the observed process. In a large number of cases, the logical process used by the computer exceeds our abilities. Using electronic, logical structures and adjusting the logical process to our perceptive system, we get to the essence of the process observed in the computer. Figures 4–5 (Dynamic Object *DIN. GF100*) represent three of 65,535 different structures, while the change of the structure over time demonstrates the relations. The positions and the color of 256 squares are defined by the Galois field module $x^4 + x^3 + 1$, which determines the 16 different states. The irreducible polynomial in the feedback $x^{10} + x^8 + 1$ gives all the possible relations.

We have attained the new quality that could become relevant to human beings if an adjustment to our perceptive system is carried out. An aesthetic object is not only an image of the cognitive process, otherwise hidden, now revealed. The laws which constitute the essence of the cognitive process become obvious. An aesthetic object is no longer only a stimulus for spontaneous associations, but an expression which in the relationship with the observer becomes the essence of cognition within the frame in which it exists. [...]



3

• 1
Vladimir Bonačić
PLN 5
1969
Computer-generated image
Photograph of oscilloscope screen
28.5 × 34.5 cm
PDP-8, oscilloscope

• 2
Vladimir Bonačić
PLN 6
1969
Computer-generated image
Photograph of oscilloscope screen
45.5 × 55.2 cm
PDP-8, oscilloscope

• 3
Vladimir Bonačić
IR. PLNS. 0044. 7714. 7554. 7744
(also *IR. PLNS – 3. V. B.*)
1969
Computer-generated image
Photograph of oscilloscope screen
[–]
PDP-8, oscilloscope

• 1–3
Produced at Ruđer Bošković Institute, Zagreb
Archive MSU Zagreb

4

5

• 4 • 5
Vladimir Bonačić
DIN. GF100
1969
Computer-controlled light object
Metal construction, electronics, electric lamps, colored transparency film, Plexiglas
135 × 152.5 × 25 cm
SDS-930, program implemented in special-purpose hardware
Programmed by Vladimir Bonačić and Miro A. Cimerman
Produced at Ruđer Bošković Institute, Zagreb
MSU Zagreb

"Dynamic Object – color slide and electronic logic (dimension 135 × 152.5 × 25 cm). A Galois field of 2^5 elements is formed as a polynomial field above GF (2), namely, 0.1; modulo polynomial of the fourth degree $x^4 + x^3 + 1$ (100). This field is equivalent to 2^4 different residues, namely, 2^4 congruent polynomials. Congruent polynomials are characterized by the same color. The field consists of 256 different elements, namely, 16 different colors. With the help of electronic logic, all possible relationships of exhibited two-dimensional elements may be observed digitally. The logic offers the possibility of observing all $2^{16}-1$, namely, 65,535 states with the help of the irreducible polynomial of the 16^{th} degree in the feedback connection $x^{16} + x^3 + 1$. Depending on the observer, the picture changes according to the clock every 200 milliseconds or 2 seconds, introducing the observer into a pseudorandom process. By means of remote control, the observer can watch each stage for as long as he likes. The digital computer has been used here."

[Vladimir Bonačić in: *tendencije 4*, exhib. cat., Galerija suvremene umjetnosti, Zagreb, 1970, n. p.]