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Author(s): Vladimir Bonacić

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# A Transcendental Concept for Cybernetic Art in the 21st Century

Vladimir Bonacić

## ABSTRACT

The cybernetic art team >bcd< believes that the cybernetic art environment, initially involved with pattern recognition and artificial intelligence research in art and science, can make an important contribution to intersubjective communication and to the sharing of insight between people. The cybernetic sculpture *Instantaneous*, which was presented for the first time during the Rome colloquium, illustrates the existence of instantaneous communication on a truly parallel architecture based on 16 Compaq Deskpro 386 computers. It also signifies a true parallel processing mode (as experienced in extrasensory perception) in which 'time sequence', 'before' or 'after' hardly have meaning. The cybernetic sculpture *Instantaneous* is seen as a contribution to a new communication medium between artists working interactively within the same system. This is a step towards intersubjective communication, through the process of reflection between artists and a transcendental Galois field.

The exploration of dematerialized transcendental processes, determined by their own hidden variables, has timeless and spaceless qualities. This exploration is the focal point of interest as far as cybernetic art is concerned.

To perceive a work of dematerialized art, to experience the presence of the hidden variables that determine the generation of a transcendental field, the artist, using heuristic methods, will need to add the dimensions of time and space. This means, for example, creating visual or audible 'windows' into the transcendental Galois field (see Appendix) to anticipate and appreciate the generation processes in the observed field.

The generating processes of transcendental fields are related to instantaneous communication. This is a concept present not only in artists' dreams but also in philosophy (Henri Bergson), extrasensory perception and quantum mechanics (behavior at the subatomic level). It will be noticed even more when parallel processing by computers becomes more highly developed in the future.

The cybernetic sculpture *Instantaneous* [1] consists of 64 'dynamic windows' simultaneously exploring the generation of a transcendental Galois field. Each dynamic window visualizes a transcendental process generated by 16 intelligent points, which are Compaq Deskpro 386 computers [2]. All 16 computers are linked to a computer network, which enables them to act in a parallel processing mode and to generate different orbits of the observed Galois field. The sculpture reveals the same hidden variables that determine the generation of the transcendental Galois field, and an unknown communication, which seems instantaneous, appears to be taking place.

*Instantaneous* is a 'dynamic object' [3]. This term refers to the impregnable unity that is established between the computer system and the work of art. To integrate computer systems and art, without allowing one to dominate the other, is seen as a step towards establishing a common language. This means that the artists and their work of art are able to communicate: artist and artwork use a common language.

*Instantaneous* is an example of a true, impregnable unity established between 16 computers, which are linked in a computer network, and a dematerialized work of art, which generates a transcendental Galois field. The resulting visual effect is an attractive one and one that has not been experienced before. The new visual effects reveal the hidden

variables that determine the generation of the transcendental Galois field.

Cybernetic art should be considered within the environment of our information society in which computers and the common language between humans and artificial systems provide essential communication; here, the term 'intersubjective communication' (a well-defined phenomenon in existentialist philosophy) acquires real meaning. The cybernetic sculpture *Instantaneous* is seen as a contribution to a new communication medium between artists working interactively within the same system. This is a step towards essential intersubjective communication, through the process of reflection between artists and a transcendental Galois field.

## A TRANSCENDENTAL CONCEPT

Cybernetic art is not anticipated to be the only art of our information society, a society that does not yet have a paradigm or a philosophy of its own. Specifically, cybernetic art is seen as the art that will portray transcendental reality, the transcendental world and its hidden variables—all of them dematerialized. All of these contradict orthodox scientific theories, notably those relating to space and time barriers (yet essential to a more human existence in the future). Cybernetic art is seen subjectively as the art that will be able to reflect our insights through intersubjective communication, which makes possible a sharing of the insight evolving between people. We believe that dynamic love, our love of others, is the fundamental aim towards which every artist and scientist should be striving, so that the computer technology that is available and being developed today will help advance human freedoms and not subject people to new forms of alienation.

The realism of the mid-nineteenth century portrayed life and emotions (of humble peasants, for example) with a realistic urgency. The abstraction (in contemporary art) reflected, in a way, life and human suffering (a permanent state of war and destruction) of our industrializing world. The investigation of the problems related to dematerialized existence and transcendental reality has taxed many artists and the greatest philosophers from Aristotle onwards, but

Vladimir Bonacić (artist, cybernetician), Bödinger Hecken 10, 5330 Königswinter 21, F.R.G.

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hidden variables and instantaneous communication determining the dematerialized processes have remained unknown, 'transcendental'.

The new quality belonging to the environment of our information society lies in the artificial systems (computers, networks and the unpredictable impact of software). The common language between humans and artificial systems has introduced this new quality, which is dematerialized information.

The possibilities within such an environment appear unlimited. At the same time, our information society has inherited existentialism's most pessimistic view—namely, that intersubjective communication is impossible. If this view is justified, human suffering will change only its form within the new environment, an environment that makes any communication possible but does not facilitate the sharing of insight between two neighbors, between people. The information environment and its anticipated impact can no longer be neglected. This is the challenge for cybernetic art and for the artist who moves effortlessly within the new information environment.

The complexity of the challenge can easily exceed the capacity of a single artist. Teamwork is advisable, and the impact of love is essential for creation and intersubjective communication among the team's members to occur. This does not really contradict existentialist philosophy, at least as far as the impossibility of intersubjective communication is concerned. The 'philosophy of love', for example, sounds heretical, for in philosophy 'love' belongs to a different category. The existentialists considered intersubjective communication impossible within the environment they imposed. It seems that the barrier of their choice was more valuable to them than the truth they were searching for.

To experience hidden variables and what appears to be within the instantaneous communication resulting from the generating process of a transcendental Galois field is certainly attractive to cybernetic art. (A similar experience is not available to orthodox scientists or mathematicians if they insist on using mathematical symbolic notation to find hidden structures within a Galois field.) Such an experience, visually appealing and conceptually interesting, does not directly

resolve the problem considered as the challenge for cybernetic art.

A contribution to this problem of intersubjective communication anticipates dematerialized hidden variables and their impact on future research, which will be open to new categories (such as love). Such research must be free from inherited barriers.

This is not to suggest that only cybernetic art should consider a number of today's anticipated hidden variables, notably those relating to quantum mechanics, genetics (hidden variables determining the unit of heredity—the gene—transmitted in the chromosome that controls the development of heredity), transcendental extrasensory fields or language (translation, for example).

Moreover, it is anticipated that at least art and philosophy will be concerned in the future with the impact of love and intersubjective communication. The impact of love is thus a challenge for cybernetic art, its real meaning for transcendental reality being its unlimited and unpredictable impact on our feelings and on our inspiration and desire to create and, of course, to communicate.

## ABOUT THE CYBERNETIC SCULPTURE *INSTANTANEOUS*

The cybernetic sculpture *Instantaneous* as a dynamic object is an impregnable unity established between 16 computers linked in the computer network and a dematerialized work of art generating the transcendental Galois field.

Two additional Compaq Deskpro 386 computers are responsible for the real-time generation of the Galois field: operation of the network, the long-term memory, real-time scheduling of 16 parallel processors using AI methods (such as heuristic search) and the interface with a graphics database. The 16 computers use the fastest 32-bit random access memory (RAM), 10 megabytes each. The total number of 'dynamic windows' is 64, visualized on 16 different monitors controlled by 16 computers.

The images used for representing the elements of the Galois field are deliberately simple so that they will not interfere visually with the complexity of the process itself. All the im-

ages are abstract, except for one sequence of realistic images symbolizing the alternatives for our information society (see Color Plate B No. 3). Instantaneous communication is demonstrated with abstract images generated in real time. (The appearance of the same patterns of visual images on all 16 monitors would recur every 50 billion years if the sculpture were left unattended during this time!) The time limit has been adapted to the limits of our perception: 50 half-frames per second. The displayable colors available are 16 million for each intelligent point, for each computer. All the different images are generated in real-time, and they correspond to the PAL TV-broadcasting standard in order to be available to TV media. Different TV standards, such as SECAM or NTSC, including HDTV, can also be used.

None of the 16 computers are redundant during the generation process. All are occupied at full power and speed. But any one of the computers can be taken out of the process and be used for something else without affecting the process of field generation. This will result in a still image, which remains on the monitor controlled by the interrupted computer. This frozen image, representing the content of the four dynamic windows or anything else, can be displayed. Relinked to the computer network but left unattended, the interrupted computer will return to its previous activities automatically and continue to 'travel' through the observed Galois field.

This also means that we have a true parallel processing mode in which 'time sequence', 'before' or 'after' hardly have meaning—except to remind us that we thought, in the past, perhaps differently.

## APPENDIX: GALOIS FIELDS

Evariste Galois was only 20 years old when he was killed in a duel in 1832. The night before his death he outlined a comprehensive theory of the roots of equations (Lettre à Auguste Chevalier), the hastily scrawled origins of what we today call group theory.

From Galois's theory, mathematicians came to learn of the importance of specifying the environment in which a statement is true or false—or perhaps entirely meaningless, hence neither true nor false. It has been

proved, by means of group theory, that a general equation of a degree higher than four cannot be solved by radicals.

It is possible, however, that the heart of Galois's theory—the theorem that an algebraic equation is solvable by radicals if and only if its Galois group is a solvable group—is merely a tributary result of Galois's true preoccupations. It would seem that Galois's contributions to culture were far more transcendental than the 'heart' of his mathematical theory.

### A World of Another Paradigm?

Galois was more a humanist and a revolutionary—he was expelled from his school, imprisoned for being a humanist and framed to fight the duel in which he was killed—than he was a professional mathematician; indeed, two outstanding mathematicians of the age, Cauchy and Fourier, rejected both Galois and his work.

Galois needed mathematics for survival, but he was unsuccessful at the latter. The world according to Galois belongs to a different paradigm. It is even possible to discover a number of indications, hidden in a way in Galois's

theory, that suggest a different level of complexity (as illustrated by the cybernetic sculpture *Instantaneous*). For example, finite fields with a characteristic of 2 (a Galois field of  $2^n$  elements) have been used to design the best-known codes for detecting and automatically correcting errors in the transmission of digital information.

Through Galois's theory, it is possible to anticipate the tremendous effect that can be produced by the smallest cause, such as a slight change in a single postulate. This concept is indispensable in contemporary cybernetics.

One of the most complex and attractive problems related to Galois's theory is the heuristic method involved in the process of forming a transcendental Galois field and revealing (again, heuristically) the hidden structure of the field. This helps us understand instantaneous communication. The very existence of instantaneous communication is under much discussion in a number of different fields, and the debate is a keen one.

Neither the problem of field formation nor the problem of the hidden

structures of a transcendental field can be considered at all using today's mathematics. The two problems may indeed be near the boundary between perception and communication—far from orthodox and therefore relevant to cybernetic art.

### References and Notes

1. Teamwork was responsible for the research that led to the creation of the cybernetic sculpture *Instantaneous*; the team, called >bcd<, has three members (Vladimir Bonacić, Miro Cimerman, Dunja Donassy) who have been working together since 1971 in the fields of cybernetic art, design and science. Recently, >bcd< has participated in a cybernetic music project that was presented for the first time during F.A.U.S.T. (Forum des Arts de l'Univers Scientifique et Technique), 19–24 October 1988.
2. The artistic concept on which the cybernetic sculpture *Instantaneous* is based became feasible for realization when the Compaq Deskpro 386, a powerful system with a uniquely fast memory, was introduced on the world market in 1986.
3. For earlier references to 'dynamic object', see Vladimir Bonacić, *Dynamic Objects* (Paris: UNESCO, 1971); "Kinetic Art: Application of Abstract Algebra to Objects with Computer-Controlled Flashing Lights and Sound Combinations", *Leonardo* 7, 193–200; and frontispiece, "On the Boundary between Sciences and Art", *UNESCO* 27, No. 1 (January–March 1977).