

LASER AND CULTURE: COMMON FEATURES IN THE BEHAVIOR OF SELF-ORGANIZATION SUBJECTS

The world is not a laser
Hermann Haken

B.N. Poizner

*Tomsk State University
Received October 29, 1997*

Here I present for a discussion the common features revealed in the behavior of subjects (initiators, drivers) of the matter self-organization (the author's term). I also propose a new interpretation of the evolutionary hypothesis by S.D. Haitun. In this paper a hierarchy of actual and hypothetical subjects of the matter self-organization is being proposed.

This paper develops the analogy between the processes occurring in a laser and those in the social and cultural life, first formulated in Ref. 1. Some of the conclusions drawn there can be extended as follows. 1. The self-organization, i.e. the establishment of the evolutionary spatiotemporal structures in a dynamic system to transform the inflow of "low-quality" resources into the "high-quality" product and devaluated, in the entropy sense, "waste" products (where the idea of quality corresponds to the openness conception by S.I. Yakovlenko (Ref. 2)), has its own initiator, or subject, as a self-reproducing information unit, that is called a primer, in genetics. 2. The fluctuations of a physical field (photons of spontaneous radiation in the case of a laser or a maser), the concentration and (or) molecular velocity field fluctuations in the cases of vibrational chemical reactions and Benard cell, and so on) are used in the technical and natural self-excited oscillators as the process primers. 3. The cultural samples (subjects of any nature, with which people conform the elements of their consciousness and behavior) and Young's archetypes (the structure models of the psychological activity, related to instincts, intuition and the heritable constituents of psyche (Refs. 3 and 4)) are used as the self-organization process primers in the social and cultural life. 4. The self-organization in the literature, arts, and science is carried out through the competitive selection of the cultural samples, some aspects of which have been explained in conceptions by V.B. Shklovskii's ("the art as a method"), Yu.N. Tynyanov (constructive principle in literature), K.S. Malevich ("added element in arts"), C. Popper and D. Campbell (hypothesis of "blind variation" of a known scientific idea, guessing of the true theory), and by Yu. Neeman (research luck).

The main goal of this paper was to construct a classification of known and hypothetical subjects of the self-organization.

Grading the complexity of primers of different nature is of our primary interest in this paper. The

easiest case is the case with fluctuations of a physical field. The gene structure is undoubtedly much more a complicated case. Among the cultural samples there such, whose structure is even more complex. Therewith the properties of relatively simple primers (for example genes) cause the dynamic pattern with the participation of more complex primers like, for instance, cultural samples.

We suggest to discuss this observation taking into account the evolutionary hypothesis by S.D. Haitun. This hypothesis assumes that the matter during its evolution towards the increase of entropy has transformed from the natural Gaussian systems to the Zipp systems of the social world. Here the Gaussian systems are understood as the systems for which the stationary statistical distributions of a random event probability may be presented by the Gaussian function. The distributions in natural inorganic life in most cases are Gaussian. At the same time the stationary statistical distributions that characterize the human activity (especially creative) and social processes are mostly of the Zipp type ($p(n) \approx n^{-\alpha}$, where $\alpha > 0$). The organic systems by their intermediate position have to be characterized by the Zipp distribution with a small value of the index α (Ref. 5).

Based on the interpretation of the mechanism of self-organization criticality by S.F. Timashev, G.G. Malinetskii, and A.B. Potapov given in Refs. 6 and 7 (in the regime of which the Zipp distribution is characteristic of the random events in a dynamic system), we explain the facts generalized in the hypothesis by S.D. Haitun by the circumstance that interconnections between the elements in social-cultural systems are more complex, strong, manifold, and nonlinear than in the biological ones, and to say nothing about those in inorganic systems.

We suggest a new formulation of S.D. Haitun's hypothesis that reads: *the matter during its evolution towards the increase of entropy, had transferred from simple self-organization subjects such as fluctuations of a physical field to genes, and then to the more*

complicated primers like Young's archetypes and cultural samples. From this follow a couple of other hypotheses.

The first hypothesis reads: *the existence is possible of other subjects of the matter self-organization that are more complex than the cultural ones.* The dynamics generated by these primers (conventionally speaking – “**hyperhistory**”), is approximately related to the history of the culture such as the latter relates to the evolution of the genetic programs.

It can be expected that those hypothetical subjects of the matter self-organization operate in within the framework of a dynamic “**hypersystem** of the highest degree of complexity (a la' matryoshka). It is called the highest because it involves not only the physical and biological, but also social and some “**hypercultural**” dimensions. It may happen that the new turn of the complexity, or perplexity as it is called in Refs. 8 and 9, is able to create some “self-organized **supercriticality**” making the “**hypersystem**” to be permanently unstable and ephemeral.

The second hypothesis reads: *one must not exclude the possibility of the existence of such subjects of the matter self-organization that are more simple than the fluctuations of a physical field.* One can think, but

only hypothetically, that the activity of such “**subphysical**” self-reproducing units of information had: (a) manifested itself most significantly during the first instants of the Universe origin and (b) influenced the establishment of the speed of light, Planck constant and other characteristics of the primers that initialize the physical processes of self-organization. The influence is approximately understood to be the same as that of the physical and chemical properties of the matter (i.e., electrons, atoms, molecules, etc.) that caused the direction, content and the speed of the biological evolution.

The guesses formulated allow one to construct a hierarchy of actual and hypothetical subjects of the self-organization (see Table I). We think that it is the necessary addition to the synergetic principles of making a comparison between the social and natural systems, and also to the scheme of “structural levels in nature and society” proposed by V. Vaidlii (Ref. 10, Table I.1, 1.1, and 1.2), to the gradation “rationalism providing evolutionary motion of the matter” by L.A. Zymbal (Ref. 11, Table 7), to the typology of “evolution information” by I.V. Melik-Gaikazyan (Ref. 12, Table 3.1), and to the fundamental principles of the global evolutionism (Refs. 9, 13, and 14).

TABLE I. Hierarchy of actual and hypothetical subjects of the matter self-organization.

Level	Primer	Distribution function	Dynamics features
“ Subphysical ”	?	?	presumably the “self-organized noncriticality ”
Physical	fluctuation of a physical field	mostly Gaussian: $\exp(-n^2/\sigma^2)$	random processes in the system elements occur independently
Biological	gene	intermediate between Gaussian and Zipphian	“self-organized criticality”
Social	Young archetype and cultural sample	mostly Zipphian: $n^{-\alpha}, \alpha > 0$	“self-organized criticality”
“ Hypercultural ”	?	?	presumably the “self-organized supercriticality ”

There is certain logic to think that the primers of “**subphysical**” self-organization processes inherently possess a particular simplicity that may be called primordial. The maximum simplicity of that singular system, within which they act, corresponds to this simplicity. The source of its nonequilibrium state is not discussed here. If it was so, the “self-organization **noncriticality**”, i.e., fundamental metastability and firmness, in its literal sense, would be guaranteed to the basic dynamics of the matter. Is not it this firmness that had been referred to by R.M. Ril'ke in the XIX Century's sonnet to Orpheus (Let our life be the shadow of disappearing clouds, however, no changes occurs in the basis).

Otherwise, it may seem so that a singular system – on the contrary to the anthropic principle (Refs. 9 and 13) – would not be reserved till the moment, when this

principle becomes a cultural sample on one of the planets.

ACKNOWLEDGMENTS

The author is grateful to V.M. Klimkin for the possibility to offer this subject for a discussion among the laser-intellectual scientists, to V.F. Tarasenko for the creative criticism, as well as to M.B. Shpizel and T.Ya. Dubnishcheva for their kind attention.

REFERENCES

1. B.N. Poizner, *Izv. Vyssh. Uchebn. Zaved. Ser. Prikl. Nelinein. Dinamika* **4**, 149–158 (1996).
2. S.I. Yakovlenko, *Vopr. Filos.*, No. 2, 41–50 (1996).
3. K.G. Young, *Problems of Modern Spirit* (Progress, Moscow, 1993), 336 pp.

4. E. Samuels, B. Shorter, and F. Plott, *Critical Vocabulary of K. Young's Analytic Psychology* (MNPP "ECI", Moscow, 1994), 182 pp.
5. S.D. Haitun, *Mechanics and Irreversibility* (Yanus, Moscow, 1996), 448 pp.
6. S.F. Timashov, Zh. Fiz. Khim. **69**, 1349–1354 (1995).
7. G.G. Malinetskii and A.B. Potapov, *New in Synergetics. Mystery of World of Inequilibrium Structures* (Nauka, Moscow, 1996), pp. 165–190
8. J. Horgan, Scientific American, June, 74–79 (1995).
9. E.N. Knyazeva and S.P. Kurdyumov, Vopr. Filos., No. 3, 62–79 (1997).
10. W. Weidlich, Phys. Reports **204**, 1–163 (1991).
11. L.A. Zymbal, *Synergetics of Informational Processes. Informativity Law and its Effects* (Nauka, Moscow, 1995), 119 pp.
12. I.V. Melik-Gaikazyan, *Information and Self-Organization (Methodological Analysis)* (Publishing House of Tomsk Polytechnical University, Tomsk, 1995), 180 pp.
13. A.N. Pavlenko, in: *Philosophical-Religious Sources of Science*, P.P. Gaidenko, ed. (Martis, Moscow, 1997), pp. 178–218
14. I.V. Chernikova, *General Phenomen of Evolution and Mankind* (Tomsk, 1994), 103 pp.