SYMMETRY AND DYNAMISM IN THE CONCEPTION OF MIHAI DRĂGĂNESCU AND IN ANTICIPATIVE SYSTEMS THEORY

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Abstract. The paper presents the notions of symmetry and asymmetry and their alternation exposed by Mihai Drăgănescu as being at the command of the movement, evolution, progress of the world. Some lines are dedicated to present the fundamental notions of informatter, orthomatter, senses and orthosenses. In the second part of the paper a mathematical approach of the symmetry in the evolution of dynamical systems is presented.

1. ABOUT SYMMETRY AND DYNAMICS IN THE THEORY OF INFORMATTER

Mihai Drăgănescu's reflections about the symmetry concept have a philosophical nature especially and they are not formalized in mathematical expressions. From his point of view, the symmetry is involved in those natural processes which are named *orthosenses* and that means to no resort to a mathematical modeling (Drăgănescu, 1989).

In the classical and well known definition, the symmetry involves a correspondence between the parts of an integer with respect to forms, dimensions and manner in which these are disposed. In the same time the symmetry is represented as a ratio, a harmony, equilibrium of the parts. All these peculiarities of the symmetry refer to static objects, states and structures but not to the situations of movement, to phenomena in evolution.

In his book about "Spirituality, Information, and Matter" (Drăgănescu, 1988) Mihai Drăgănescu has an essay entitled "Symmetry and asymmetry" where he makes the following affirmation: "A curious thing is happened: the dynamical principles can have a certain symmetry". In this context, the author sees the apparition of the dynamism by a break of the symmetry, because the symmetry "never is perfect in nature".

The following lines express Mihai Drăgănescu's concept about symmetry so as this results from the mentioned essay and other works, between these being "Symmetry and asymmetry of senses" (Drăgănescu, 1993).

The symmetry is "the simplest, beautiful and true order". But it does not offer explanations for the phenomena in movement, being only a frame for the development of dynamic processes, because it is too static. The symmetry is not the source of the development and progress. The symmetry has priority, but not for

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long time, and co-exists with its complementary, the asymmetry. The break of the symmetry and the passing to an asymmetry assure the process and dynamism of a phenomenon.

I quote the following Drăgănescu's statement: "We remark a fundamental trend to symmetry in the frame of dynamical principles and not only in that of those that are static … The nature is poetic by its symmetries, it generates two time symmetries, both in its static principles and in dynamical principles" (Drăgănescu, 1988).

In accord with his philosophical principles regarding the profoundness of the material world (Drăgănescu, 1989) Mihai Drăgănescu asserts that the two sorts of principles are generated by *orthosenses*, which are phenomenological information: "the nature introduces a certain symmetrical order by each *orthosense*, as a kind of an economy of resources. But the multitude of orders of the symmetries and their combinations in universe lead to the breaking of symmetries and the universe can not exist without them". In other words, imperfection is necessary for the existence of universe.

The nature is moving by the interference of more symmetries. Drăgănescu affirms: "A physic universe is closer by the perfection than a biologic universe or than an informational with conscience universe". I try to interpret the above assertion by the observation that the speed of the states modification is greater in the biological medium than in a physical one and a faster passing from a state to another take place in systems with conscience.

Regarding the universe with conscience, Drăgănescu has the following explanation: The breaking of symmetry, inherent for the display of matter and so of the human spirit, depends on the finding of other spirituals factors which attenuate the evil and intensify the good by the symmetries' beauty. The principle of symmetry and asymmetry shows that the evil never can be eliminated, but it may be reduced in a great measure (Drăgănescu, 1976).

The evolution by the alternation symmetry – asymmetry exists also in the profound matter (*material profunda*). This principle is enunciated by the creator of the theory of *informatter*, Mihai Drăgănescu. Here, I must present the meaning of this concept and of the structure that was described by Drăgănescu. The profound matter is presented by two components: *informatter* and *orthomater* (named also *lumatia*). *Informatter* is the informational matter, and here information is presented as being a phenomenological specific physic process, as a physical sensibility. Processes from *informatter* are named *orthosenses*. An *orthosense*, that is engendered by fluctuation into *informatter*, leads to a structure in this one and so to the construction of certain laws of physic universe; this universe is formed by coupling of the *lumatia* and structured *informatter*; this coupling itself maintains the structure on *informatter*. A part of *informatter* remains unstructured and it is available for new structures. Because of *informatter*, the profoundness of the material world is able to be the substratum of infinite possibilities of the matter activities.

Informatter is not a conscious entity and it does not contain intelligence, but it is an ingredient of any living organism; this one has access to information by intro-opening. *Orthomatter* (*lumatia*), as a component of the profound matter, is no-structured and it cannot be structured by itself, but only by *informatter*. *Orthomatter* is a matter with an energetic feature and remains in an immobility and total equilibrium without the second principle, the *informatter*. *Orthomatter* and *informatter* constitute the fundamental matrix of the world (Drăgănescu, 1990).

Here I add a comparison from the banal, daily life: the egg with its two components, the glair and the yolk. The glair contains the energy, the food for the development of the embryo, therefore for the life that exists in the yolk, this one containing the genetic information. So the egg is a very universe and can be presented as the couple of *informatter* and *orthomatter*.

The *orthosense* is defined as a phenomenological process into the *informatter*, it is phenomenological information. An *orthosense* can appear from itself in *informatter* or can be generated by an intro-opening of the organism towards the *informatter*. A universe has a set of *orhosenses* at its basis and in a formal mode these are displayed by the dimensions of the state of elementary particles; these *orthosenses* exist because of the couple *informatter – orthomatter* and without this couple they disappear by a phenomenon of relaxation.

Mihai Drăgănescu sees into *informatter* the motion as being generated by the alternation symmetry – asymmetry for the configuration of *orthosenses*: "Generally, some senses can prevail other senses in an infra-conscious community can prevail others, for example those of good related those of evil and so it is produced an asymmetry of the distribution of senses face of all the possible axes" (Drăgănescu, 1993).

Here I remark the apparition of the idea of dynamism: "Even it is possible that the senses of the infra-conscious collective produce new senses which influence organisms and minds by their interference or by characteristic processes, analogous to the multiply and non-linear resonances, by new phenomenological trends and creative processes. Mihai Drăgănescu writes about the thirst of senses, that is the symmetry of senses, as a first principle and to which the second principle, the principle of selection of the senses (that is the asymmetry) is added. The couple of the two principles defines "the trend of becoming" (or formation). These trends are the consequence of the fundamental *orthosense*: To exist (*in sine, by sine, intro-sine*).

The concept of harmony is also treated by Mihai Drăgănescu. He affirms that the symmetry is not necessarily a harmony: "an only symmetry is beautiful, pure, but even from the fact that it is solitary it is not in harmony with something else… The harmony presumes harmonization of more factors".

In connection with the above affirmation, I observe that a system can have harmony between its parts, while the symmetry refers to an isolated object or to all system at a fixed moment. Especially Drăgănescu refers to the aesthetic face of the

phenomena of symmetry and harmony, and then to their impact upon the interior life of human and upon the social life (Drăgănescu, 1976).

2. A MATHEMATICAL APPROACH OF THE SYMMETRIC EVOLUTION FOR DYNAMICAL SYSTEMS

In this section of the paper I try to express, using mathematical formulae, a case of a couple of systems which condition one-another and where a symmetric and even harmonious evolution appears. These considerations are based by my published results (Otlacan, 2009).

Like as any mathematical modeling, some definitions and hypotheses are at the start point of a theory, then following the equations; at the end, the solutions of these equations are interpreted in the language of the concrete systems which put the problem.

The results refer to the couple of systems which are in a reciprocal influence by two dual aspects: anticipation as information from the future and retardation as information from the past. I take as a point start the definition and mathematical formalization linked by this class of systems.

Definition 1 (Robert Rosen, 1985). "An anticipative system is a system containing a predictive model of itself and/or of its environment, that allows to change state at an instant in accord with the model's predictions pertaining to a latter instant".

Definition 2 (Daniel M. Dubois, 2003). An anticipatory system is a system whose present behavior is based on past and present events, but also on future events built from the past, present and future events.

Passing to the mathematical formalism, t is the present or the current moment, $t+\tau$ with $\tau>0$ is a moment in the future, $t-\tau$ is a moment in the past, $x(t)$ is the state of the system at the moment t; the function x is possible to be defined from $-\infty$ to $+\infty$; p represents some parameters which can be inputs in system. The evolution of the state of an anticipative system is given by the derivative of the function $x(t)$ in a relation having the following form:

$$\frac{\mathrm{d}x(t)}{\mathrm{d}t} = F\left[x(t-\tau), x(t), x(t+\tau); p\right]. \tag{1}$$

Thinking back at the observation of Mihai Drăgănescu, when we look for harmony we must consider two entities, in this case two dynamical systems. Because the dual and symmetric notions are past – future, a pair of systems which we want to have a harmonious evolution are considered as having the current states $x(t)$, $y(t)$ and being in a mathematical relation given by two differential equations, F and G being functional (functions of functions) and a and b real positive constant numbers:

$$(2)\qquad \begin{cases} x'(t) = F[y(t+\tau)] - ax(t) \\ y'(t) = G[x(t-\tau)] - by(t). \end{cases}$$

The study of these differential equations was proposed by Daniel Dubois who named them "mixed advanced – retarded differential equations". The system with the state $x(t)$ is named "master system", the other, $y(t)$ is "slave system". The evolution of x depends on its current state and on a future state of y; the evolution of y depends on its current state and on a past state of x.

I solved some particular cases of the functional F and G.

Case a: $F[y\ (t\ +\ \tau)] = y(\tau)$, $G[x(t\text{-}\tau)] = x(-\tau)$, representing values of these states x and y in a future time $t = \tau$, respectively in a past time $t = -\ \tau$; the differential system is the following:

$$(3)\qquad \begin{cases} x'(t) = y(\tau) - ax(t) \\ y'(t) = x(-\tau) - by(t). \end{cases}$$

Each equation has a solution becoming with the present moment. But we must impose a correlation; each function has to verify both the equations. So we find the following solution of the system (3):

$$(4)\qquad x(t) = x(-\tau)\frac{1-e^{-at}}{1-e^{a\tau}} + x(0)\left[e^{-at} - e^{a\tau}\frac{1-e^{-at}}{1-e^{a\tau}}\right],$$

$$(5)\qquad y(t) = y(\tau)\frac{1-e^{-bt}}{1-e^{-b\tau}} + y(0)\left[e^{-bt} - e^{-b\tau}\frac{1-e^{-bt}}{1-e^{-b\tau}}\right].$$

The last expression can be obtained by the above mentioned duality or by direct calculus. The duality is the property that marks both equations of the differential system and the state functions of the two conjugate systems.

Regarding the functions (4) and (5), we remark, as a *conclusion*: If the conjugate systems with the current states $x(t)$ and $y(t)$ work according to the differential system of equations (3) and without any intervention from the part of the master system, then these states can be expressed independently from one another. But there is a significant difference between the two systems: While the master system builds its current state based on its own past x $(-\tau)$ and its present state x(0), the slave system behaves like a system which has its future enclosed in the program of its own evolution.

Case b: is more general than the precedent case, having $F\ [y(t+\tau)] = y\ (t\ +\ \tau)$, $G[x(t-\tau)] = x(t-\tau)$; the differential system is the following:

$$(6)\qquad \begin{cases} x'(t) = y(t+\tau) - ax(t) \\ y'(t) = x(t-\tau) - by(t). \end{cases}$$

Thinking that it must exist a continuity regarding the "shift" τ, we solve first the differential system with $\tau = 0$:

$$(7)\qquad \begin{cases} x'(t) = y(t) - ax(t) \\ y'(t) = x(t) - by(t). \end{cases}$$

The solution of this system is the pair of functions:

$$x(t) = C_1 e^{r_1 t} + C_2 e^{r_2 t} \quad ;$$
$$y(t) = C_1 (a + r_1) e^{r_1 t} + C_2 (a + r_2) e^{r_2 t} .$$

Here C_1 and C_2 are arbitrary constant numbers, and r_1 and r_2 have the following values:

$$r_1 = \frac{-(a+b) + \sqrt{\Delta}}{2}, \quad r_2 = \frac{-(a+b) - \sqrt{\Delta}}{2}, \quad \Delta = (a-b)^2 + 4 .$$

This result, obtained with $\tau = 0$ and the hypothesis of the continuity mentioned before, asks to look for exponential solutions in the case with $\tau > 0$, that is the case of the equations (6).

Having $y(t) = e^{rt}$, the first equation gives the solution to the function $x(t)$:

$$(8)\qquad x(t) = \frac{1}{a+r} e^{r(t+\tau)} + (b + r - \frac{1}{a+r}) e^{r\tau - at} .$$

The function y (t) will represent the state of the slave system at every time t and not at $t = \tau$ only, if both equations (6) take place simultaneously. We found this solution as being the pair of functions:

$$(9)\qquad \begin{cases} x(t) = \dfrac{1}{a+r} e^{r(t+\tau)} \\ y(t) = e^{rt} . \end{cases}$$

Interpreting this result, we can say that the current states $x(t)$, $y(t)$ of the above described systems have an exponential development; the ratio of the two trajectories is remarkable:

$$(10)\qquad \frac{x(t)}{y(t)} = \frac{e^{r\tau}}{a+r} .$$

This is a constant number when the shift $\tau > 0$ is fixed. That means the master system follows in a straight line its slave system and reciprocally. The two systems have their proportional states at every moment, in other words, we can say they have a symmetrical behaviour.

This result leads us to introduce the definition of a certain type for symmetry of the evolution of dynamical systems.

Definition. The symmetry by anticipation and retardation is the concept describing by the proportionality of trajectories which are developed in time by a pair of conjugate dynamical systems, so that the evolution of the first system depends on its current state and on a future state of the other system, while the evolution of the second system depends on its current state and on a past state of the first one.

The pair (master system, slave system) forms an entity characterized by harmonious and aesthetic equilibrium. It is my conclusion deduced from the formula (10).

I introduced also the notion of symmetry by duality of dynamical systems (Otlacan, 2009). This does not ask the proportionality. It is the case of dynamical systems for which the current states $x(t)$ respectively $y(t)$ verify a differential system of equations of the type (2), because this system itself indicates the duality $x \leftrightarrow y$, $\tau \leftrightarrow -\tau$, $a \leftrightarrow b$, so that after a function is found, the other can be written by duality.

Going back to Drăgănescu's hypothesis regarding the apparition of the movement (dynamism) by the breaking of symmetries, we find that the pair of conjugate systems by anticipation and retardation confirms this hypothesis. At least in a movement described by the differential equations (6), when the exponential functions are imposed by calculus, the two systems develop in a harmony represented by a proportionality ratio. The breaking of symmetry appears when other terms (given by a perturbation) are introduced in the differential equations. An eloquent example is presented by the pair of systems man, environment (Otlacan, 2008).

Nearer to the Drăgănescu's theory about *informatter*, a pair of systems represented by the intelligence and affectivity is interesting to be studied.

REFERENCES

1. Drăgănescu, M., (1976), Sistem şi civilizaţie (System and Civilization), Editura Politică, Bucureşti.
2. Drăgănescu, M., (1988), Spiritualitate, informaţie, materie (Spirituality, Information, Matter), Editura Academiei RSR, Bucureşti.
3. Drăgănescu, M., (1989), Inelul lumii material (Ring of the Material World), Editura Ştiinţifică şi Enciclopedică, Bucureşti.
4. Drăgănescu, M., (1990), Informaţia materiei (Information in Matter), Editura Academiei Române, Bucureşti.
5. Drăgănescu, M., (1993), Eseuri (Essays), Editura Academiei Române, Bucureşti.

6. Dubois, M.D., (2003), Mathematical Foundations of Discrete and Functional Systems with Strong and Weak Anticipations, *Anticipatory Behavior in Adaptive Learning Systems*, Springer, pp. 110–132.
7. Otlacan, E., (2008), Systems in a Retardation and Anticipation Relation: Mathematical Developments, Interpretations, Examples, Editor Daniel M. Dubois, American Institute of Physics, AIP CP 1051, pp. 151–165.
8. Otlacan, E., (2009), Symmetry of conjugate systems with anticipation and retardation, Kybernetes, Emerald Group Publishing Limited, UK.
9. Rosen R., (1985), Anticipatory Systems, Pergamon Press, New York.