Symmetry of STRUCTURE

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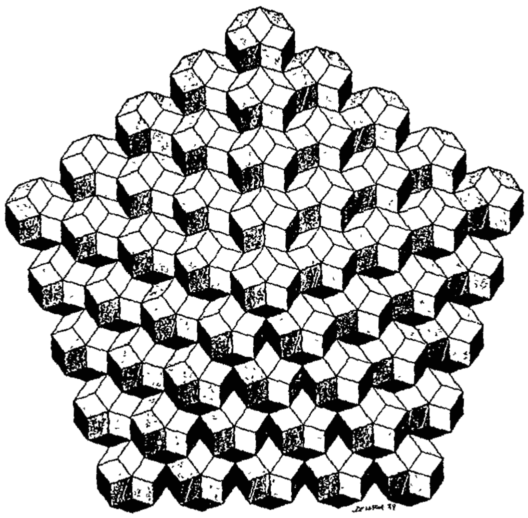
Abstracts

II.



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HARMONY OF THE UNIVERSE

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The theory formulates the principle of identity of opposites, which defines harmony as a general regularity, as well as establishes three numerica- laws of harmony and their experimental substantiation in music and natural sciences.

§ 1. Definitions. Harmony is a law of integrating parts into the whole. Categories of harmony are: stability, invariance, equilibrium, conservation. They determine the integrity. Assume the following statements (axioms): 1) motion is specific and diverse; it determines qualitative difference between things; 2) all these things contain a general feature; this general feature is what recurs in phenomena, what is identical in them. The first affirms non-identity (difference) in phenomena and the second - identity. The basic properties of opposites are as follows: identity is abstract, uniform and irrelative; non-identity is concrete, diverse and relative. The connection between identity and non-identity means the identity of opposites:

$$\text{A is non-A,} \qquad (1)$$

where A is identity, non-A is multitude: non-A is B, is C, is D, but each non-A is A. Formula (1) connects the most important categories of dialectics: this connection reflects non other than the relation of general and individual (whole and parts), i.e. harmony.

A	non-A
Conent	Form
Essence	Reality
Quality	Quantity
Identity	Difference
Stability	Instability
Invariance	Variance
Conservation	Transformation
Equilibrium (rest)	Motion
Abstract	Concrete
General	Individual
Uniform	Diverse
Absolute	Relative
Whole	Parts

Let us take several examples. Consider any notion, for instance, "a tree". It contains no differences of specific trees. This is identity, i.e. general. Let A in formula (1) correspond to the notion "tree". Then non-A are specific trees - birch, oak, etc. Let A correspond to the notion "rest", then non-A are specific motions (rectilinear, curvilinear ...). The statement "each non-A is A" implies: every motion is rest, every individual is general, etc. (note that general statement: motion is rest or individual is general is false - this is identification of opposites). An example: "every motion is rest" is consistent with the principle of relativity of mechanics, due to which "... it is impossible to determine experimentally, whether the motion of a given coordinate system is accelerated or uniform and rectilinear, while the observed effects result from gravitational field ..."*. In terms of rest-motion the identity of opposites may be formulated

* Einstein A. Physics and Reality. Moscow, Nauka Publ., 1965, p. 72.

as follows: motion is diversity, where each particular case abstracted from this diversity is rest.

The essence of formula (1) appears to be a new type of generalization, which is called essential or qualitative. It means opposite to the conventional statement: individual case is generalization. This is due to the fact that the relation of individual and general determined by resides in their coincidence, identity, occurring when diversity is eliminated in a concrete, i.e. each individual case. This means such an individual case which is contained as common in all the cases of this kind. It is called as an important (or general) individual case. Examples: 1) rest is each (hence general) case of motion; 2) series $\Sigma\ 1/n$ (1) is an important individual case of series $\Sigma\ 1/n^s$ (2). Series (2) is a quantitative generalization of series (1); series (1) is a qualitative generalization of series (2). This leads to numerical laws, since arithmetic is exactly such an individual case (basis) of mathematics. General definition: quality is a fundamental individual case inherent in all the cases of this kind; quantity is a multitude of cases containing (expressing) a basic determining case. Consequently, numbers (digits) can express not only quantity, but also quality, for instance, a golden number.

Analysis of space and time categories from the point of view of qualitative generalization makes it possible to assert harmony as the essence of space-time. The expression of space-time essence in space-time coordinates loses its sense. Therefore, the laws of harmony are formulated in the form of new mathematical principles based on a successive chain of qualitative generalizations.

§ 2. Law 1 - qualitative symmetry (S_q). According to Minkovsky, a uniform and rectilinear motion corresponds to a straight world line and an accelerated motion - to one of the curves. According to the general theory of relativity, an accelerated system is indistinquishable from an inertial one. This provides a means for interpreting formula (1) as a relation of a straight line and a curve and expressing this as the following equation

$$a^n = na, \qquad (2)$$

i.e. in the form of relation of additive $\Sigma\ a=a+a+a...=na$ (straight line) and multiplicative $\Pi\ a=a\cdot a\cdot a...=a^n$ (curve) principles, where n is an integer or a fraction. The important individual case of solving equation (2) when a=n=2 leads to constructing a qualitative symmetry. In accordance with principles na and a^n two symmetries are constructed: arithmetic (S_A) $a=x=x-b$ with center $x_A=(a+b)/2$; geometric (S_g) $a/x=x/b$ with center $x_g=\sqrt{ab}$. The essence of S_g is in connection of inverse numbers a^{+1} and a^{-1}. The essence of S_A is connected with numbers 2^n (n - integer) and generalized by the qualitative equivalence formula

$$a \risingdotseq 2^n a, \qquad (3)$$

where symbol $\frown$ means qualitatively equal. Formula (2) reflects the dichotomy principle which forms the basis for many phenomena, specifically in biology: division of cells by half; in music: octave similarity (melody when transferred from one octave to another retains its quality). Nex, the relation or generalization of S_g and S_A is established. This occurs if relationship $x^{+1} \frown x^{-1}$ is satisfied for x_g. In accordance with formula (3) this means $x^{+1}/x^{-1}=2^n$, hence $x=(\sqrt{2})^n$. This case S_g is called a qualitative symmetry (S_g) with center $x_q=x_g=\sqrt{ab} = (\sqrt{2})^n$.

§ 3. <u>Transformations of S_q</u>. The numerical intervals between two adjacent powers of $\sqrt{2}$ are called S_q ranges and the powers of $\sqrt{2}$ - range bounds. The ranges are designated as $\overset{i}{R}$ or $\overset{j}{R}$ (i. j - range numbers). Let: $\ldots \overset{-3}{\div} (\sqrt{2})^{-2} \overset{-2}{\div} (\sqrt{2})^{-1} \overset{-1}{\div} (\sqrt{2})^{0} \overset{+1}{\div} \sqrt{2} \overset{+2}{\div} \ldots$. The numbers above are range numbers. Let number is in $\overset{+1}{R}$. This means $\sqrt{2}>a>(\sqrt{2})^0$. The two adjacent ranges cover the interval of an actave. One range is equal to a half-octave. Transfer of a number from one range to another according to formula (6) (see below) is transformation. The transformation of number of into b is designated as $a \underset{\frown}{\perp} b$, or $a_i \underset{\frown}{\perp} a_j$. The transformation of S_q takes the form

$$a \underset{\frown}{\perp} a^k \cdot 2^n, \tag{4}$$

where k= +1 or -1, alternating in each subsequent range; n is integer changing every other range by one. Let us designate each range bound as $\lfloor$ and introduce number a into $\overset{+1}{R}$. Its transformation will be as follows:

$$\begin{array}{l} \lfloor a \overset{+1}{\cdot} 2^0 \lfloor a^{-1} \overset{+2}{\cdot} 2 \lfloor a \overset{+3}{\cdot} 2 \lfloor a^{-1} \overset{+4}{\cdot} 2^2 \lfloor a \overset{+5}{\cdot} 2^2 \lfloor \ldots \\ \lfloor a^{-1} \overset{-1}{\cdot} 2^0 \lfloor a \overset{-2}{\cdot} 2^{-1} \lfloor a^{-1} \overset{-3}{\cdot} 2^{-1} \lfloor a \overset{-4}{\cdot} 2^{-2} \lfloor a^{-1} \overset{-5}{\cdot} 2^{-2} \lfloor \ldots \end{array} \tag{5}$$

The general formular of transformations for any a_i (or law 1):

$$a_i = a_j^b \cdot 2^c, \tag{6}$$

where a_j is a preset number; $b=k_i \cdot k_j$ and may assume only two values: $b_1=+1$, $b_2=-1$; number c depending on b may also take only two values: $c_1=n_i-n_j$, $c_2=n_i+n_j$. If $b=b_1$, then $c=c_1$; if $b=b_2$, then $c=c_2$. Values k and n are determined by expression (4) or (5). The transformations of S_q form a group. For instance, let $a_{+2}=1.618$ (golden section). Find a_{-1}. From (5) $k_{+2}=-1$; $n_{+2}=+1$; $k_{-1}=-1$, $n_{-1}=0$. According to formula (6) we obtain $a_{-1}=0.809$.

§ 4. <u>Law II - disturbance of symmetry (S_d)</u>. Law II - the essence (invariant of S_q - arises from the fact that in the general case $x_g \neq x_A$. Law II gives rise to numerical series by the formulae $C_k^{(1)} = (1+2^k)_i$ and $C_k^{(2)} = |\sqrt{2}(1+2^k)|_i$, where k is the integer, i means that the number obtained in the brackets should be transformed into the i-th range by formula (6). When i=-1 we obtain the following 10 numbers of S_d: 0.713, 0.718, 0.729, 0.750, 0.800, 0.884, 0.943, 0.970, 0.985, 0.992. These 10 numbers unevenly divide S_q into 11 parts. The uniform tempering of the S_q range (qualitative generalization of S_d numbers) is achieved by means of 10 integral powers of the number $\alpha=(\sqrt{2})^{-1/11}=0.96898...=$ $=0.969^{-1}$ (R). Number α (measure of disturbing symmetry) is a shift from one. The main center of S_q is $x_q=\sqrt{2}=\alpha^{-11}$; a shift from $\sqrt{2}$ into R^{+1} is set by number $\alpha^{-10}=$ $=(\sqrt{2})^{10/11}=2^{5/11}=1.3703509\ ...=\beta$, which is the essence of S_d. Number β in the first 6 characters coincides with the constant $\hbar c/e^2=1.3703598\cdot 10^2$. The tempering of the S_q ranges connects numbers 1.37 and 10. This connection also arises from equation (2) $a^n=na$, where at $a=10$ $n=0.137128857\ ...$, i.e. $10^{0.137}=$ $=0.137\cdot 10=1.37$.

§ 5. Law III - golden section. From equation $\Phi^n+\Phi^{n+1}=\Phi^{n+2}$ it follows: $\Phi=(\sqrt{5}+1)/2=1.618\ ...$ and $\Phi^{-1}+\Phi^{-2}=1$ ($\Phi^{-1}=0.618$, $\Phi^{-2}=0.382$). Number Φ was know, but here due to S_q it was given a wider interpretation. Law III follows from law II. Therefore, numbers Φ and 1.37 are connected. Let $a_{-2}=\Phi^{-1}$, $b_{-3}=\Phi^{-2}$. From formula (6) we find a_{+1} and b_{+2}; $x_g=\sqrt{a_{+1}\cdot b_{+2}}=1.37$. This connection points to the heuristic nature of S_q. Thus, the proposed theory integrates the three problems (disturbed symmetry, number 137 and golden section) posed by modern science and considered to be different into one.

Besides, the theory is supported by extensive experimental material: the author descovered the laws of harmony in musical series, periodic table, planetary distances, in musical works, micro- and macrocosmos, biology, genetics, etc. The theory posed new problems: enigma of number 0.417, number 3, 123, etc.

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