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# Universal Dynamic Complexity as the Basis for Theoretic Ecology and Unified Civilisation Transition to Creative Global Sustainability<sup>†</sup>

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**ABSTRACT.** The recently proposed new, universally applicable, rigorously derived and reality-based concept of dynamic complexity provides a unified basis for the causally complete understanding of any real, multi-component and multi-level system of interacting entities, including the case of earth system and global civilisation development. This crucial extension with respect to other existing notions of “complexity” is obtained due the unrestricted, universally nonperturbative analysis of arbitrary interaction process leading to the new, rigorously derived concept of dynamically multivalued (redundant) entanglement of interacting components. Any real system with interaction is described here as a sequence of autonomously emerging “levels of complexity”, where each level includes unceasing, dynamically random change of multiple system configurations, or “realisations”, each of them resulting from dynamic entanglement of interaction components coming, generally, from lower complexity levels. Dynamic complexity as such is universally defined by a growing function of the number of those explicitly obtained system realisations (or related rate of their change). Mathematically rigorous, realistic and universal nature of unreduced dynamic complexity determines its unique role as a basis for theoretical ecology dealing just with explicit manifestations of very high, multilevel interaction complexity of unreduced planetary dynamics. This conclusion is confirmed by several directions of universal complexity application to global change understanding and monitoring. They include the rigorously substantiated necessity of civilisation transition to the superior level of complexity involving new, intrinsically unified and causally complete kind of knowledge (initiated by the “universal science of complexity”), qualitatively new kind of material production, social structure, and infrastructure. We show why that new level of civilisation development is intrinsically “sustainable”, i. e. characterised by creative, complexity-increasing interaction between “production” and “natural resources” that replaces current contradiction between them. The latter cannot be avoided in principle within conventional, “protective” ecology approach, which is naturally extended to the qualitatively new, creative ecology at the superior level of knowledge and living. Transition to the new kind of knowledge involves a deep conceptual shift from abstract, vain and purposeless (but also subjectively “repulsive” and objectively dangerous) “calculation/modelling of empirical observations” dominating in modern science (and “way of life” in general) to the unreduced understanding and conscious creation involving rigorous and intrinsically unified description and positive development of such “complex matters” as “life” (on all scales), “art”, “intelligence”, and “spirit”.

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## 1. New stage in ecological studies: The need for a unified theoretical basis

Modern level of ecological research and Earth system understanding is characterised by elaborated empirical knowledge about the planet and civilisation state, including accumulated and growing practical problems and urgent need for their solution. Persisting degradation of natural environment and “human dimensions” (both within and beyond material “living conditions”) is thoroughly measured and documented in almost every small detail by a technically, empirically powerful civilisation that cannot, however, initiate a definite, provable positive change towards unreduced sustainability (even in its most technically “developed” centres). The evident reason for that contradiction is directly related to the *absence* of genuine, *causally complete understanding* of occurring processes complexity, at all its levels and on the full, global scale. Existing “general ideas” and “computer simulations” (often indistinguishable by their result from straightforward “interpolation” of previous evolution tendencies) are prone to “unpredictable jumps” and “regular errors” of the same order as the “main” effect they describe, giving rise to “scientifically based” but opposed opinions about the very fact, direction, meaning and consequences of the occurring “global change”.

Such situation in ecology and “Earth system science” is not surprising at all, taking into account that canonical, scholar science fails explicitly in its attempt to understand the real origin, structure and dynamics of even much simpler entities, starting from the simplest massive object, the isolated electron. Well-known “quantum mysteries”, “relativistic paradoxes” and other “weird” features of “new physics” remain unexplained for a hundred years now, despite most powerful computer and mathematical tools applied, which means that “rigorous” and “exact” canonical science paradigm is based on *postulated para-scientific mystification*, already at its most fundamental levels. Can one imagine that this type of knowledge can be well suited for the needed consistent, reliable understanding of the whole planetary life complexity, including innumerable elementary constituents and the deepest, ever changing hierarchy of their interactions? In view of the evident huge deficiency of conventional science in genuine understanding of real system dynamics, one may have serious doubts about *any* possibility of *truly scientific*, rigorously based and objectively, provably reliable description of Earth system dynamics, or *theoretical ecology*, able to reproduce the best efficiency of a physical theory.

Quickly changing from useless to dangerous in quality, the scholar science doctrine explosively inflates in quantity of its separated *imitations* of reality, which is another reason for urgent transition to the new, *intrinsically unified* and *totally realistic* kind of knowledge that can only be based on the consistent, reality-based concept of *dynamic complexity*. This is especially evident in the case of ecology directly dealing with the *unified diversity* of unreduced complexity of Humanised Nature. In this report we outline the universal concept of complexity with the above properties and results of its application to Earth system analysis, showing why and how one can indeed obtain its causally complete and practically efficient understanding [1,2].

## 2. Universal science of complexity vs scholar “science of complexity” and “nonlinear science”

Thinking about description of ecological system complexity, one should take into account that usual “science of complexity”, “nonlinear science” and their various branches and approaches are all parts of the *same, basically unchanged* canonical theory containing *no* really new “paradigm” and thus inheriting inevitably all scholar science deficiencies: basic separation from reality (over-simplification), irreducible separation between fields and approaches, absence of creativity [3], and resulting practical inefficiency [1,4,5]. The latter *cannot* be hidden any more behind successes of *empirically based technology*, as it was before. Blind, but *critically* powerful technology has become *really* dangerous *only today* because *now* it *can* alter (and *destroy*) natural system complexity within its *total* depth.

Contrary to that spoiled relation between conventional science and reality it tries to describe, the *Universal Science of Complexity* [1,2] *derives all* existing entities and their properties from the *unreduced*, universally nonperturbative analysis of underlying *interaction* processes, in *exact* correspondence with their *dynamic emergence* in Nature. It involves *qualitatively new phenomenon*, concept and “paradigm” called *dynamic redundance*, or *multivaluedness* (involving also *dynamic entanglement*) and consistently *derived* within the unreduced analysis, *without any postulated “principles”*. As a result, *all* existing entities are obtained as *intrinsically unified* parts of the *universal hierarchy of dynamic complexity* of the world, while all the observed types and properties of their behaviour, such as chaos/randomness, self-organisation/order, synchronisation, fractality, adaptability, and change/creativity, are obtained as *particular cases* of the *unique dynamical process of complexity development* and *system realisation change* (see below, sections 3–5, for more details).

The above properties of the universal science of complexity are actually the basic demands for *any truly consistent* knowledge, which is *unique* as such, but has *multiple* and *unified* aspects, similar to the *real world* it describes. Since ecology deals with the unreduced, full-scale complexity of natural systems and is supposed to be of critical practical importance, it *has no right* to deviate from the demands for *efficient* science of complexity, which means also that ecology *must* become now a well-substantiated, “exact” science, as opposed to its half-political, half-philosophical, speculative, and often futile version of “degradation measurement”.

The glaring, evident deficiencies of the scholar “science of complexity” can be further specified in the following way (cf. also [1,4,5]):

- (1) always *reduced, perturbative analysis* (including conventional “chaos”, “synergetics”, “nonlinearity”, etc.) just cutting *essential dynamical links* within a developing interaction process, which constitute the *unique origin* of *creative complexity* of Nature;
- (2) imitative, *artificial insertion of simplified*, mechanistically “fixed” (non-dynamical) versions of “expected”, empirically (or numerically) observed properties (like randomness, structure, adaptability, fractality);
- (3) *absence* of consistent, universal *definitions* (and *origin*) of the *main* notions, such as *complexity*, nonlinearity, chaos (randomness), emergence, replaced by speculations or inconsistent imitations.

Universal science of complexity reveals the *exact, fundamental reason* for the *inevitable* canonical science deficiency (cf. [3]): because of perturbative reduction, it describes a *dynamically single-valued, or unitary, projection* of reality and takes into account *only one* system realisation from its *many* really existing, incompatible and *permanently changing* realisations. “Multi-stability”, “unstable periodic orbits”, “attractors”, etc. are but single-valued (sequential, trajectorial), non-universal, abstract *imitations* of unreduced, omnipresent dynamic multivaluedness of *any real interaction* process.

It follows that any *practically efficient* “science of ecology”, being a “natural consumer” of the science of complexity, should *never* use unitary substitutes for dynamic complexity (including “chaos”, “nonlinearity”, self-organisation, “criticality”, etc.), since they are *basically inconsistent*, quantitatively and qualitatively *incorrect*, and provide *no* true understanding, but only infinite series of “well established” (= “computer-simulated”) *imitations* of reality.

### **3. Unified dynamic complexity and its applications**

If one avoids any perturbative reduction of a real interaction process, then it appears that the unreduced mutual “influence” of all the system components leads to emergence of *multiple* versions of their entanglement, each of them representing an *equally probable*, complete version of compound system configuration called “realisation” [1,2]. Realisations are mutually incompatible, but being also equally probable and “inevitable”, they are forced, by the driving, *regular* interaction, to *permanently replace each other*, in a *causally (dynamically) random* order thus defined. That unceasing, *internally chaotic*

*realisation change process* constitutes the basis of *any real entity existence*, contrary to its imitation in canonical science by a “fixed”, static shape. A self-developing hierarchy of such chaotic processes forms any larger “meta-system” and the world in the whole, where the results of each interaction level constitute interaction components at higher levels of the unified hierarchy of complexity.

The *value of (dynamic) complexity* as such is *universally* defined as a growing function of realisation number, or related rate of their change, equal to zero for (actually unrealistic) limiting case of only one realisation (see also section 4). Note that one deals here with system structure realisations that are *explicitly obtained*, together with their *dynamically determined (a priori) probabilities*, by the *unreduced interaction analysis*, instead of being “guessed”, “postulated”, or inserted objects.

The *rigorous* analysis of the universal science of complexity is successfully applied to systems at various complexity levels, from the lowest level of elementary particles (“quantum” behaviour) up to intelligence, consciousness, and their products usually studied in the humanities [1]. Solution of “unsolvable” problems of usual science is obtained in terms of unreduced dynamic complexity, providing a *causally complete explanation* for the postulated “mysteries” of scholar theory and “intuitive” (empirical) notions of artistic and “humane” disciplines, which proves *intrinsic universality* of the new knowledge. The *universal, rigorous criterion* of *good, harmony, progress, and objectively positive purpose* of any activity is established: (optimal) *growth of dynamic complexity-entropy*.

#### 4. Universal science of complexity: Extracts from mathematical formalism

The starting “existence equation” for the system “state function”  $\Psi(\xi, Q)$  describes arbitrary system or interaction process with  $N$  components:

$$\left\{ h_0(\xi) + \sum_{k=1}^N [h_k(q_k) + V_{0k}(\xi, q_k)] + \sum_{k=1, l>k}^N V_{kl}(q_k, q_l) \right\} \Psi(\xi, Q) = E\Psi(\xi, Q), \quad (1)$$

where  $\xi \equiv q_0$  and  $Q = \{q_1, q_2, \dots, q_N\}$  denote interacting degrees of freedom (system variables).

General solution for the measured system density  $\rho(\xi, Q)$  ( $\rho(\xi, Q) = |\Psi(\xi, Q)|^2$  or  $\Psi(\xi, Q)$ ) is obtained as a *dynamically probabilistic* sum of system realisations:

$$\rho(\xi, Q) = \sum_{r=1}^{N_{\mathfrak{R}}} \oplus \rho_r(\xi, Q), \quad \rho_r(\xi, Q) = |\Psi_r(\xi, Q)|^2, \quad (2)$$

$$\Psi_r(\xi, Q) = \sum_i c_i^r \left[ \Phi_0(Q) \psi_{0i}^r(\xi) + \sum_{n, i'} \frac{\Phi_n(Q) \psi_{ni'}^0(\xi) \int d\xi' \psi_{ni'}^{0*}(\xi') V_{n0}(\xi') \psi_{0i}^r(\xi')}{\eta_i^r - \eta_{ni'}^0 - \varepsilon_{n0}} \right].$$

Here  $N_{\mathfrak{R}} (= N)$  is the total realisation number (at a given complexity level), coefficients  $c_i^r$  are found from the dynamic boundary conditions and determine realisation emergence probabilities,  $\{\alpha_r\}$ , while the eigenvalues,  $\{\eta_i^r\}$ , and eigenfunctions,  $\{\psi_{0i}^r(\xi)\}$ , are found from the “effective existence equation”,

$$\left[ h_0(\xi) + V_{\text{eff}}(\xi; \eta) \right] \psi_0(\xi) = \eta \psi_0(\xi), \quad (3)$$

where the operator of *effective (interaction) potential (EP)*,  $V_{\text{eff}}(\xi; \eta)$ , is given by its action:

$$V_{\text{eff}}^r(\xi; \eta_i^r) \psi_{0i}^r(\xi) = V_{00}(\xi) \psi_{0i}^r(\xi) + \sum_{n, i'} \frac{V_{0n}(\xi) \psi_{ni'}^{0*}(\xi) \int d\xi' \psi_{ni'}^{0*}(\xi') V_{n0}(\xi') \psi_{0i}^r(\xi')}{\eta_i^r - \eta_{ni'}^0 - \varepsilon_{n0}} \quad (4)$$

and

$$V_{nn'}(\xi) = \sum_k \left[ V_{k0}^{nn'}(\xi) + \sum_{l>k} V_{kl}^{nn'} \right], \quad (5a)$$

$$V_{k0}^{nn'}(\xi) = \int_{\Omega_Q} dQ \Phi_n^*(Q) V_{k0}(q_k, \xi) \Phi_{n'}(Q), \quad V_{kl}^{nn'} = \int_{\Omega_Q} dQ \Phi_n^*(Q) V_{kl}(q_k, q_l) \Phi_{n'}(Q), \quad (5b)$$

$$h_k(q_k) \varphi_{kn_k}(q_k) = \varepsilon_{n_k} \varphi_{kn_k}(q_k), \quad (6)$$

$$\Psi(\xi, Q) = \sum_{n \equiv (n_1, n_2, \dots, n_N)} \psi_n(q_0) \varphi_{1n_1}(q_1) \varphi_{2n_2}(q_2) \dots \varphi_{Nn_N}(q_N) \equiv \sum_n \psi_n(\xi) \Phi_n(Q). \quad (7)$$

The  $r$ -th realisation probability,  $\alpha_r$ , is obtained as

$$\alpha_r(N_r) = \frac{N_r}{N_{\mathfrak{R}}} \left( N_r = 1, \dots, N_{\mathfrak{R}}; \sum_r N_r = N_{\mathfrak{R}} \right), \quad \sum_r \alpha_r = 1, \quad (8)$$

where  $N_r$  is the “elementary” realisation number in the  $r$ -th “compound” (observed) realisation.

The *value of dynamic complexity*,  $C$ , is universally defined by any growing function of realisation number  $N_{\mathfrak{R}}$ , equal to zero for only one system realisation:

$$C = f(N_{\mathfrak{R}}), \quad \frac{df}{dN_{\mathfrak{R}}} > 0, \quad f(1) = 0, \quad (9)$$

for example,  $C = C_0 \ln(N_{\mathfrak{R}})$ . Complexity thus defined is also a measure of system *chaoticity*.

The *universal equation (evolution law)* for the generalised action-complexity,  $\mathcal{A}(x, t)$ , and “generalised distribution function” (or *wavefunction*),  $\Psi(x, t)$ , is given by the *unified Hamilton-Schrödinger formalism*:

$$\frac{\Delta \mathcal{A}}{\Delta t} \Big|_{x=\text{const}} + H \left( x, \frac{\Delta \mathcal{A}}{\Delta x} \Big|_{t=\text{const}}, t \right) = 0, \quad \mathcal{A}_0 \frac{\Delta \Psi}{\Delta t} \Big|_{x=\text{const}} = \hat{H} \left( x, \frac{\Delta}{\Delta x} \Big|_{t=\text{const}}, t \right) \Psi(x, t), \quad (10)$$

where general and specific expressions for the Hamiltonian function  $H(x, p, t)$  and operator  $\hat{H}(x, p, t)$  can be obtained [1] and unreduced, *dynamically multivalued* solution of eqs. (10) is implied.

## 5. Universal hierarchy of complexity and transition to superior civilisation level: Creative sustainability

Any complex system, including a planet “ill with civilisation”, is a *permanently changing* structure, where *change* (system *evolution*) can be *universally* described as *complexity development* (or *unfolding*), which means *transformation* of system dynamic complexity from a “latent” (folded) form of *dynamical information* (generalised “potential energy”) to the “explicit” (unfolded) form of

*dynamical entropy* (generalised “kinetic energy” or “heat”), so that the sum of the two, or *total dynamic complexity*, remains *unchanged* (*universal conservation, or symmetry, of complexity*) [1,2], as shown schematically on Fig. 1.

Because of *dynamical discreteness* of any unreduced interaction [1], system evolution always occurs in a *qualitatively nonuniform* sequence of structure-creation “steps” (Fig. 1), where relatively flat “plateaux” (*levels of complexity*) are connected by very quick “jumps” (*revolutionary transitions* between levels). At the *end* of each plateau system structure is “old” and “decadent” (degrading), while immediately after each jump it is “young” and “progressive”. It is very important that dynamic complexity-entropy *always grows* during *any* stage of evolution, contrary to the basically incorrect picture of usual, *dynamically single-valued* science (of complexity), where any new, “ordered” structure emergence is described as a *decrease of entropy* (in contradiction to entropy growth law).

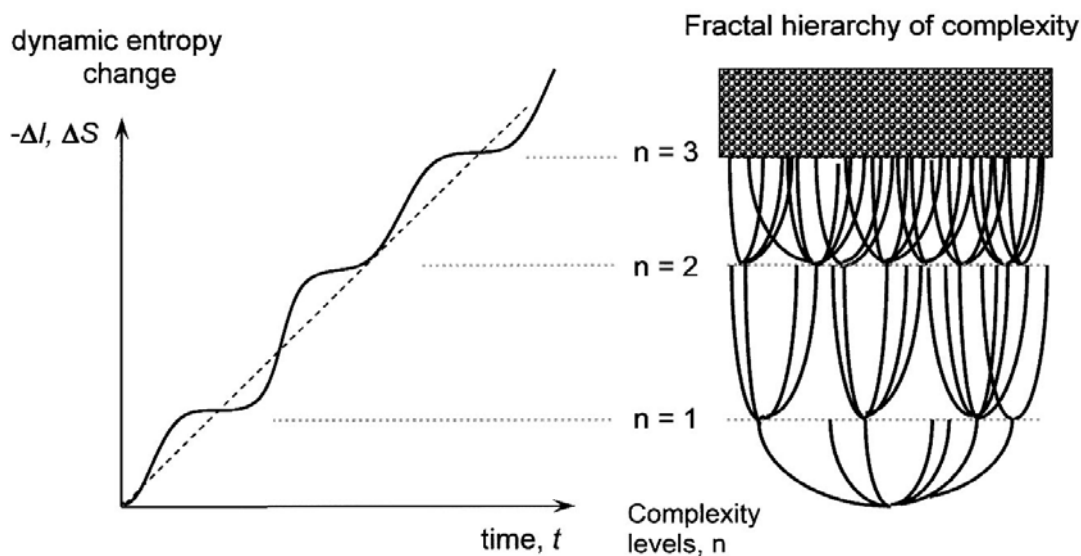


Figure 1. Scheme of universal system development (interaction-driven structure creation process) by transformation of decreasing complexity-information ( $I$ ) into equally increasing complexity-entropy ( $S$ ) governed by the symmetry (conservation) of total complexity,  $C = I + S$ .

The attained phase of development of *Earth system complexity* determines the degree of its *sustainability* that acquires thus a well-defined *dynamical (creative)* origin. Direct comparison of the observed global change with the unified curve of complexity development shows that *right now* we are *at the end* of development of a very big complexity (sustainability) level, and the *only* possible way to avoid the growing degradation that *inevitably* ends up in a global disaster is to *ascend* to the next, *superior level of civilisation complexity (and sustainability)*.

Any “protective” measures at the current complexity level *cannot* stop the degradation: *one cannot overcome (generalised) entropy growth*. It is the new, fundamentally based conclusion of the universal science of complexity applied to the global system dynamics. However, we can use the *same* evolution law in a *positive* way by passing to a *much* higher, *qualitatively* different level of dynamic complexity-entropy, where our activity, remaining useful for humans, will also be useful, or “sustainable” (*complexity-increasing*), with respect to environment, instead of modern basic conflict between them. One deals here with the transition from modern “protective”, *basically losing* ecology to “creative ecology” *at the superior complexity (sustainability) level*, where the *more* we create, the *better* it is for the *whole* system, including “environment”, which becomes less “natural” (it is not natural already now), but *essentially more* complex (rather than less complex as it happens inevitably at the current complexity level). The superior level of civilisation complexity includes *permanently*

*creative sustainability, or sustainable creation, which means a fine mixture of “flat” (inertial) and “revolutionary” (propulsive) modes of complexity unfolding. Civilisation development at the level of sustainable creation satisfies the universal criterion of good and related aim/meaning of progress: optimal (largest possible) unfolding of complexity, from dynamic information of real potentialities to dynamic entropy of emerging, more complex structures. This is also the rigorously specified, universal criterion of genuine sustainability.*

## **6. Sustainable creation at the post-tech civilisation level**

### **6.1. New kind of knowledge guides unlimited growth**

Transition to the superior level of civilisation complexity is the *only* positive issue from the emerging End of the current level. Its specific *difficulties* are related to “cooperative” action of *all* system parts that should participate in a *large and “coherent”* change. The universal “linkage” that can efficiently guide the system can only be based on a *system of knowledge* providing *complete* understanding of unreduced system complexity and related *criterion of truth*. That *new kind* of knowledge automatically enters as a major component into the emerging level of *sustainable creation*, where it should provide *conscious, dynamical control* of unreduced, *progressively* growing complexity-entropy.

Universal science of complexity [1] initiates a *working* basis of such new kind of knowledge and clearly demonstrates its qualitative advantages over conventional knowledge (science, art, etc.). This qualitatively new role and level of knowledge specifies the *true* meaning of a popular idea of knowledge-based society, as opposed to the modern age of (empirical) “technology-based society”, with its *pretentious*, but actually *fruitless* “basic science” that tries to hide its total *failure* (in a major function of unreduced reality *understanding*) behind independent, *purely empirical* advances of technology (instrumentation). It could not be otherwise and cannot continue any more, as official science (including its “complexity” imitations) invariably and severely reduces the full richness of *dynamically multivalued* reality to *only one*, mechanistically fixed realisation, which corresponds to *zero complexity* of effectively *zero-dimensional* (point-like) world “model”. The forthcoming new level of civilisation complexity involves society based on a *new kind* of knowledge, whose results are *intrinsically realistic, universal*, and thus accessible to and created by *everyone* ( $\neq$  modern “popularisation of science”). It *unifies* an unlimited range of *unsplit* applications, from fundamental physical reality, now causally understood, to conscious brain dynamics and all its creations [1].

### **6.2. Complexity-increasing production**

At the current level of civilisation complexity dominated by *Unitary System* (section 6.3) almost any activity acquires the properties of “industrial” production realising the *degradation phase* of unified complexity development (section 5) associated with major *destruction* of initial component complexity, which is the *true origin* of main ecological problems of today. Once this way of production (at the current level of complexity) remains unchanged as such, all its internal “refinement” (including “recycling”, “resource-saving technology”, etc.) can at best slightly prolong the phase of global degradation, but never stop it: *entropy growth is invincible*.

The problem of complexity-destructive mass production can be resolved only at a superior level of civilisation complexity (*Harmonical System*) by a dramatic transformation of major production processes to their *complexity-increasing* version that corresponds to the phase of “progress” of universal complexity development process. This change involves a densely entangled combination of “material” and “human” factors always guided, however, by the *universal criterion* of highest possible (optimal) *growth of complexity-entropy* determined by the *symmetry* of complexity (section 5).

Material aspects imply a qualitative shift from modern domination of “zero-complexity” (regular and massive) technology of Unitary System (including “biotechnology”, “food technology”,



“recycling”, and any other kind of “soft” and “green” technology), which can only *destroy* “natural” system complexity, to “complex-dynamic technologies” (with always growing dynamic complexity), which will *add* unreduced dynamic complexity to their “raw materials”. It involves a transition to much more “fine-structured” and *unpredictable* in detail, *creative* and “living” kind of *strongly interactive* production process (governed by the same complexity growth criterion).

Human aspects of complexity-increasing production stem from dramatic increase of *creative* and *individual* character of *massive* production process. It includes *direct* participation of *consumers* in “individualised” product creation, so that stages of “invention”, “production” and “consumption” are *dynamically, inseparably unified* into a single process of genuine, complexity-increasing *creation*.

All achievements of modern machinery and communications are to be used and further developed in both material and human aspects of new production, but in the whole it won't be “machine-dominated” (or “instrument-dominated”), but rather “intelligence-dominated” (or “complexity-dominated”) type of activity that can be characterised as a *superior level of “intelligent” handicraft* (or arts). It implies a dramatic, qualitative *change of purpose* with respect to the current technology-dominated, empirico-instrumental kind of development.

### 6.3. Non-unitary governance and social structure

Intrinsic, creative sustainability at the superior civilisation level needs a qualitatively new kind of social structure and governance never experienced before. All social system versions realised until now, including totalitarian, democratic, or meritocratic rules, belong in reality to the *same*, basically rigid, “centralised” and “administrative” kind of governance, the *Unitary System*, trying to *suppress* natural complexity growth. The latter therefore can happen only in the form of “revolutions” involving antagonistic, ruthless fight and typically leading just to another version of the same, unitary structure.

Contrary to popular Unitary System myths, another kind of social structure and governance is not only possible, but is the *only realistic* possibility for further civilisation *progress* and thus also for its *survival*. According to the universal criterion of unreduced science of complexity [1], that superior kind of social life, called *Harmonical System*, is characterised by stimulation and optimisation of *progressive* complexity development within a *distributed, freely changing* kind of structure, which is possible *only* at the *superior* complexity level of the whole system dynamics.

The detailed structure of governance and social development in the Harmonical System, as well as the transition from Unitary to Harmonical system, can be specified with the help of universal science of complexity and its unified criterion of progress. The Harmonical type of social structure can be described as unreduced, open interaction between multiple independent units resembling “market economy” for consumer products, whereas Unitary System of power can be compared to “centralised”, “administrative” economic order, with the corresponding difference in the two system efficiencies. Note, however, that the “generalised phase transition” to the Harmonical system proposed here should not be confused with “open society” imitations, such as introduction of “non-government organisations (NGOs)”, *within* the Unitary system of *actually unconditional* power of few people over many.

Contrary to self-interested assertions of the dominating Unitary “democracy”, its superior, Harmonical version is as feasible, and *unavoidable*, as free-market economy inevitably emerging from a unitary economic order. The Unitary-Harmonical transition in governance and social complexity development becomes *urgently needed* today because it constitutes an indispensable part of the completely prepared civilisation transition to the superior complexity level, the *Revolution of Complexity* [1], or *sustainability transition*, without which *none* of growing “global problems” can be solved. In other words, a price to pay for their solution *cannot* be lower than a *qualitative* system change from Unitary to Harmonical type, but the prize for the right solution, or Harmonical System advantages, will be correspondingly big: “big prize for a high price” is the inevitable result of modern “revolutionary” stage of civilisation complexity development.

#### **6.4. New type of settlement and infrastructure**

The forthcoming superior level of complex civilisation dynamics associated with the Harmonical social structure should inevitably involve qualitatively new kind of human settlement, including “land use and cover”. So far as the now dominating Unitary System supports complexity-suppressing production ways and settlement types because of its intrinsic low-complexity tendency, the forthcoming Harmonical System gives rise to qualitatively higher complexity of both production processes and settlement (land cover).

The new structure of settlement and land use is due to domination of such “natural” (= “truly complex-dynamical”), but now *man-made*, elements as (artificial) forests and other kind of higher-complexity, “submerged”, distributed, and “living” structures in building, transport and other infrastructure construction. Here also one changes from a “machine-oriented” type of structure with limited dynamic complexity to a “nature-oriented” type with *unceasingly growing* complexity-entropy. Feasibility and particular details of this qualitatively new kind of civilisation structure can be specified with the help of the same unified, rigorous criterion of the universal science of complexity [1,2]: maximum possible unfolding of potential interaction complexity.

The resulting superior kind of civilisation structure at the Harmonical level is characterised by the corresponding *unlimited diversity* of its particular realisations for various “initial” natural conditions, ethnic traditions, and emerging development ways, as opposed to the inevitable tendency towards a standard, mechanistically limited “comfort” at the current level of industrial development. That *intrinsic* diversity of superior, growing complexity *includes sustainable solution* to “problems of poor countries” that can *only grow* at the level of Unitary System, *irrespective* of *quantities* of efforts applied, which emphasises once again practical importance and urgency of unreduced sustainability transition.

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- [5] J. Horgan, *The End of Science. Facing the Limits of Knowledge in the Twilight of the Scientific Age* (Addison-Wesley, Helix, 1996).