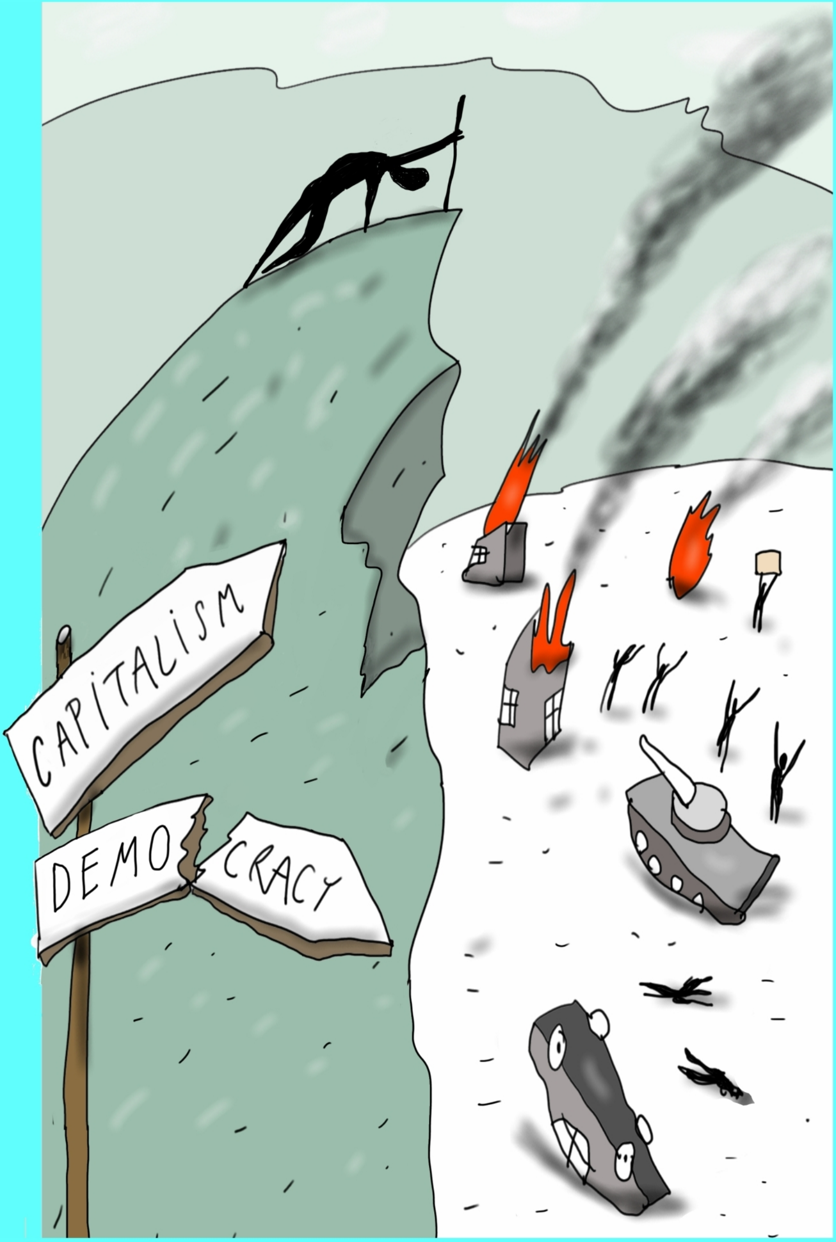
Juraj Pavlasek



Sapiens: From Neuronal Networks to Global Capitalism

Human Nature and World Order

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SAPIENS: FROM NEURONAL NETWORKS to GLOBAL CAPITALISM
Human Nature and World Order

By Juraj Pavlasek

1. Introduction

1.1 Concise book prospectus

This book is about people – it describes the urge drivers of human behavior, called natural properties. This subject is off-color and neglected in publish discourse; but it is a stupid attitude – this topic is simply too significant to be dismissed.
The presented information aims to contribute to the synthesis of natural science findings with knowledge about the neuropsychic processes of man. Those processes influenced by urges co-determine the socio-economic relations, ethics, and ultimately the world order. Activities resulting from ignorance, neglecting, or idealization of human qualities lead to social disturbances and cause a fatal ruining of nature.
Therefore this book. 21.588 words

Key words: neuropsychology, urges, socio-economy, democracy, capitalism, world order

1.2 „Thinking hurts“

“J” who I have known – as they say – forever can be described as my lifelong companion. Our contacts happen suddenly and randomly; nevertheless, communication always has the nature of sharing information with a common internal voice. Even pauses have their severity they are perceived and judged.

"J" can be characterized as a rational skeptic with acceptable natural science awareness. He does not hide his ignorance and it can be said that his curiosity – the desire to know – suppresses the desire to own. He puts a value on intelligent humor and friendship. He appreciates the existence of man – genus the Homo, species Homo sapiens, subspecies Homo sapiens sapiens (HS) – if it is associated with an interest in "understanding the world" and creative activity.

In his view, this understanding means an awareness of the relationship between natural laws and being HS, who is perceived as an integral part of the animal kingdom. It also entails an understanding of how 'natural' (?) (*Pictogram (?) expresses unclear content/scope of the concept*) characteristics of HS, affects the existence of the HS community. The Earth is perceived as a self-organizing system with a functional interconnection of living (flora and fauna) and inanimate systems (planet Gaia).

The interest of “J” in this issue can be a source of information for potentially interested persons. Their feeling that knowledge is provided in a rather austere language is correct. Unnecessary words accompany the ignorance; and, moreover, nonsense is annoying. Citations are not used; whoever wants to, he/she will look for resources and do their research.

The behavior of the recipients usually reveals their condescending attention (none of them have ever physically attacked "J"). Interest provokes a realistic description of the world, which is a plot of coincidence and necessity. Evolution is a struggle for survival; in this story, the term like "good and justice" lacks any meaning in the pre-human forms of living. In the case of HS, they have a value of utopian desire.

2. From an abiotic matter to prebiotic structure

Those who do not believe in the six-day festival of the world creation miracles also believe. They believe that the origin of our universe was ***singularity*** and the ***Big Bang***, which gave rise – described by the language of the General Theory of Relativity – to space-time with the chaos of subatomic particles. Views about the nature of the universe evolved into fields, strings, loops, twisters, gravitons, quantum vortexes, and finally, to a dynamically evolving network of processes.

Stories of the kind "*from the inanimate to the living*" are interpreted by conceptual categories on a scale of molecules (with the guilty feeling of neglecting quantum phenomena). The authors of theories about the origin of life on Earth assume the following prebiotic processes (physical-chemical development):

- Grouping atoms into ***molecular structures*** in a favorable environment (non-isotropic chaos – with the existence of gradients) for ***relational relations*** – cause with consequence and consequence as the cause.

Note 1: The formation and extinction of various molecules take place continuously in the biosphere.

- Some molecular structures were temporarily ***persistent*** (slowed degradation associated with defining boundaries of the entity by energy barriers) in a state of ***dynamic equilibrium*** (***attractor*** = ordered state cycle of the chemical reaction).

• Persisting ***molecular structures have become part of the environment***; they interact with each other, and the environment (physical parameters) influenced them.

• Each entity – as part of the environment – affected the existential chances of other entities (***a form of rivalry*** and/or co-evolutionary ***symbiosis***).

• Clusters with the ability to release some a part of the substances (catabolites) and energy in the form of heat into the environment (***dissipation*** – reducing their own disorder = ***entropy***) have acquired the capacity to increase ***ordering*** at the expense of increasing the entropy of the environment (***influencing the environment***).

• Increasing the ordering (***structuring***) of the dissipative system gave rise to ***increasingly complex*** (***organized complexity***) molecular clusters (some with ***catalytic action*** – changing the chemical reaction rate and allowing reactions to proceed).

• ***Dissipative structures*** with properties of ***unbalanced and unstable*** systems (maintained by environmental energy), with ***bifurcation points*** of instability, responded (***novelty detection sensors***) to environmental changes (***stimuli***) – a form of "***perception***".

• The ability to differentiate ***certain*** environmental ***parameters*** based on ***the specificity and/or threshold sensitivity*** (***measurement***) ***of the sensors*** has been developed.

• The reactions at the bifurcation point of instability were of a ***step-change nature*** (***phase transformation***) to ***new organizational structures*** (***recombination, mutation***), with the resultant ***diversification*** of molecular systems (why does it resemble social revolution?).

• ***Structural and functional transformation*** (a form of ***"cognitive" process***) evoked by the stimulus, meant ***adaptation*** of the system (***self-organization***) and also a way of ***the recording – retention of information*** – about the environment (a form of ***the memory***).

• Increasing ***the complexity of the molecular entities*** and their ***diversification*** has led to ***an increase in their interaction possibilities*** (***the extent of the state space***), which meant increasing the ***complexity of the environment*** and expanding the register of environmental stimuli. Molecular entities have ***adapted*** to such a situation by further increasing their structural and functional complexity, which has expanded their ***register of reactions*** ("***decisions***") to stimuli. This positive feedback has led to a spectacular increase in the organization (***trend of an increasing organization***).

• A wider repertoire of reaction possibilities leads to the likelihood of the occurrence of unpredictable (***emergent***) phenomena of ***the self-organization*** based on coupled cycles of chemical reactions (***coherent reactions*** of system entities). The complexity of these reactions allows analysis at the macroscopic rather than at the microscopic level. For example chemical oscillator, chemical "clock", or changing patterns of ordered activity (Belousov and Zhabotinsky, and also Brusselator).

• Adaptation processes were a response not only to changes in the abiotic environment but also to adapting molecular systems (***adaptation to adaptation***).

• New states of dynamic equilibrium were the result of ***cyclic, non-linear processes*** regulated by ***feedback loops*** (***self-regulation***) potentiating or suppressing activity/reactivity in ***molecular networks.***

• The crucial moment was the emergence of ***a dissipative structure with a replication capacity***, i.e. the ability to create own copies.

Note 2: A guide to replication is the knowledge of DNA, RNA, and autocatalytic pathways

• This resulted in adaptable, self-organizing and self-regulating (***autopoiesis***) molecular structures with replication capability.

• Their existence was ***selected*** (a form of ***natural selection***) by:

– Speed and stability – accuracy (error frequency) of the replication process.

– Adaptation and the resulting effectiveness of the structure pattern persistence in a multi-alternative environment.

• Subsequently, the replicated system has been defined/demarcated against the environment by a 3primordial membrane – ***a spatial boundary*** has appeared (formation of external and internal environments). "Keeping the process in place" contributed to maintaining ***the identity*** of the structure.

The process of formation of a complex system that creates itself, adapts to the environment (self-organization***)***, demarcates and reproduces itself is such an intricate and dynamic set of reciprocally structural and functional changes (***coincidence***, ***non-linearity***, ***instability***, ***imbalance***, i***rreversibility***, and ***change of entropy***) that each description is only an approximation. The important message is that the changes from the more likely situation (chaos) to less likely state (order) are not determined by an external "planner"; the evolutionary trajectory and the emergence of prebiotic structures – with the emergent seeds of cognition – is the result of neither intentional nor conscious effort. They came into existence and still are because they can exist. This is the result of a chaotic disorder where the presence of differences is the driving force for the appearance of structures that can detect gradients and direct energy through chains of spontaneous reactions for usage in conformational changes. These transformations mean preserving information about the environment and adopting the system's reactions to the situation. The mechanisms of mass, energy, and information joining evoke a feeling of randomness. However, determination of the degree of the randomness/necessity is difficult.

Professional opinions assume that the emergence of prebiotic structures and the appearance of life on Earth are part of the fundamental laws of our Universe; therefore, it should be as surprising as rolling a ball on an inclined plane. Experiments to create the life we observe are still ongoing in research laboratories.

The results of experimenting with the virtual life of digital "organisms" existing in computer memory are inspiring. For example, the Tierra program simulates evolutionary processes: the growth of complexity, adaptive self-organization, mutations, self-replication, competitive rivalry (as for the memory space), and the emergence of parasitic "organisms".

For creationist considerations, questions about "irreducible" complexity and, especially, the fine-tuning of the fundamental physical constants of our Universe that are essential for the emergence of life (as we know it), represent a very fruitful field.

3. Life

Note 3: Also in Wikipedia, the definitions of life are different. Usually, properties that are not manifested by an inorganic mass, are given.

Frequently, the ability of life to create from a more probable (chaotic state) less probable – increased order (diminishing entropy) is mentioned. Furthermore, it is the utilization of energy obtained by ***metabolism***, for adaptation and reproduction, which in the higher developmental forms is connected with the emergence of consciousness. Very economically, life is referred to as the process of harvesting energy associated with acquiring and processing information. According to such definitions, a virus (a particle, a parasite – which can replicate only in a cell) does not belong among living organisms. The basic part of life is ***the cell***.

Essentially, HS is a complex multicellular organism. Therefore, it makes sense to make – in minimalist extent – some remarks (picked out from a huge knowledge of molecular biology, biochemistry, and biophysics) about the structural and functional principles of the cell.

3.1 Cell – comments on structural and regulatory mechanisms

Each cell – as well as prebiotic structures– consists of chemical compounds. The qualitative difference lies in a higher degree of complexity and arrangement. It is relatively isolated and simultaneously opened the molecular micro-world enabling the exchange of substrates and energy with the external environment while maintaining the stability of the internal environment. Cell metabolism is a dynamic coupling of a large number of processes (parallel, spatially displaced and dispersed over time) that take place in chemical networks (for illustration: several thousand different molecules are involved in the metabolism of the intestinal bacterium Escherichia coli). The continuous flow of matter and energy is the basis of the cell's life cycle (growth, reproduction, movement, intercellular communication).

Components of the eukaryotic cell (with a nucleus) are:

- Superficial membrane
- Cytoplasm
- Nucleus
- Biomembranes (compartmentation of the internal environment)
- Fibrillary organelles – cytoskeleton, microtubules, contractile microfibrils
- Other organelles: mitochondria, Golgi apparatus, endoplasmic reticulum, ribosomes, lysosomes, chromatin, nucleus, centriole, inclusions, peroxisomes.

3.1.1 ***The membrane system*** (surface membrane and internal cell division by biomembranes), together with cell organelles, creates conditions for ***the localized functional specialization***. This means the possibility of ***different control processes*** based on their different origins and/or partaking of different molecules. Spatial dislocation is associated with the necessity of their ***functional interconnection – by metabolic pathways*** with the involvement of ***membrane transport mechanisms. The compartments help to create gradients*** (concentration, electrochemical).

3.1.2 ***Surface membrane***. Its principal function is to separate the cell and at the same time ensure the reception of chemical signals into the internal environment of the cell. This is done by transmembrane transporters regulated by ***metabotropic receptors*** and cascades of secondary intracellular messengers of metabolic pathways; similar functional principles apply to the transfer of substances from the cell. The result is a constant composition of the internal environment and stability of ***the transmembrane potential***. The membrane is a support matrix for peripheral and integral proteins as well as for surface antigens.

Note 4: Some additional details on the surface membrane functions ate givenin in Part 4.

3.1.3 ***Spatial regulation of biochemical processes***. The components of the metabolic cycle taking place in one compartment may be transported into it from another region. In such a manner the possibility of targeted regulatory interventions arises in different ways, at different locations and at different times – at certain phases of the molecular chain activity.

3.1.4 ***Metabolism***. This means biochemical reactions that produce proteins, enzymes, hormones (and many other molecules); the ultimate consequence is energy harvesting which is used in the metabolic processes (energy-dependent reactions) and in the work required to change ***the spatial shape*** of the molecules. The point is that involved molecules have a complex structure (size and spatial arrangement) with different types of bonds between their sub-units and different locations of the reaction sites. This implies the specificity and necessity of interventions in their spatial configuration. This is the role of biocatalysts (enzymes) that activate or prevent their participation in the chain of biochemical reactions. This may also result in the opening of a pathway for the movement of molecules through membrane channels – driven by a gradient, or active – energy-subsidized transport across membranes. Cyclic repetition of chained conformational changes can be manifested on the macro level by movement (muscle fiber contraction, the molecular motor rotating with the flagellum of a one-cell organism).

3.1.5 ***Genetic information***. It is a data set contained within the structure of a DNA molecule (***genetic memory***) that is transcribed from a DNA template into an RNA strand. In the translation process, involving tRNA, the nonessential amino acids are polymerized into polypeptide chains on the ribosomes; these proteins (structural proteins and enzymes) form cells and determine their function.

Principles of genetic code:

• Information is determined – encoded by a sequence of 4 nucleotides of the DNA molecule stored in the cell nucleus: G – guanine, A – adenine, T – thymine, C – cytosine.

• The code is read in triplets.

• The sequence of three nucleotides determines one amino acid.

• Word length varies – amino acid chains are proteins.

• Words are separated by a special character.

• The code is degenerative (several different triplets encode the same amino acid).

• The code is universal for all organisms.

Fully differentiated cells (in organs with specialized function) use different parts of the genetic information stored in the nucleus. ***Immediate-Early Genes***, which are temporarily activated by various stimuli, may be important for adaptation (as well as pathogenic) mechanisms.

4. The nerve cell – comments on structural and regulatory mechanisms.

Nerve cells, i.e. ***neurons and glial cells*** form the central nervous system (CNS = spinal cord and brain) and peripheral nerves. There are about 10^{12} neurons (and no fewer glia cells surrounding them) in the brain (approximately 1400g). Each neuron has approximately 10^{3} synaptic connections (***synapses***) with other neurons (= ~ 10^{15} synapses). A non-negligible part of the CNS is brain ventricles and interstitial space with extracellular fluid (~ 14% of brain volume), membranes ensheathing brain and spinal cord, and vascular supply.

Neuronal functions are referred to as:

• ***Excitability*** – ability ***to detect*** *and* ***react*** to changes (stimuli) in the external environment ("externalization" of the CNS) as well as in the internal locations.

• ***Conductivity*** – the ability to ***transmit received information*** to further neurons, or – as an execution command – to effectors (muscles, glands).

Which tricks are used to accomplish these functions?

4.1 Structure.

In most neurons, the predominant feature is their length. Multiple inputs for centripetal transmission of signaling to the neuron (***from different sources***) and mostly one output – ***axon*** (performing centrifugal conduction of information/command from the neuron) also over a ***considerable distance*** and often for ***a different number of target structures*** (axonal branching).

4.2 Surface membrane.

With specific permeability (selector) across ***membrane channels*** (protein molecules) for $\mathbf{K^+}$, $\mathbf{Na^+}$ and $\mathbf{Cl^-}$ ***ions*** ($\mathbf{K^+}$ – high conductivity, $\mathbf{Na^+}$ – low conductivity, $\mathbf{Cl^-}$ – very low).

4.3 Membrane potential.

4.3.1 ***Protein molecules*** with ***a negative charge*** ($\mathbf{P^-}$) are a constant part of the internal environment of the neurons.

4.3.2 ***Different ion concentrations***. Many $\mathbf{K^+}$, little $\mathbf{Na^+}$ and $\mathbf{Cl^-}$ in the internal environment, and vice versa in the external ones (***concentration gradients***).

4.3.3 ***High channel permeability*** for $\mathbf{K^+}$ ions. It leads to a tendency for their diffusion – driven by concentration gradient – into the external environment.

4.3.4 ***Opposing force***. When positive K^+ ions leak from the internal environment, the efficiency of $\mathbf{P^-}$ electronegativity – which counteracts the osmotic pressure of $\mathbf{K^+}$ ions – increases.

4.3.5 ***Dynamic equilibrium***. The stopping of outward leakage of the $\mathbf{K^+}$ ions is achieved at the level of ~ –70 mV (internal environment negative); this is the so-called ***membrane potential*** (***MP***).