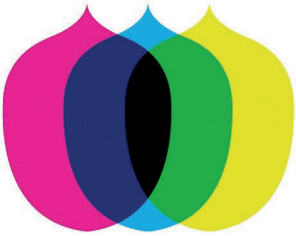

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THE SPACE-TIME CONTINUUM AND THE TEKTOLOGICAL ORGANISATION OF THE EARTH-SYSTEM

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In 1829 the Russian philosopher Petr Cadaaev wrote in one of his *Filosovskye Pisma* (Philosophical Letters) that impressive vastness and uniformity are distinctive characteristics of the Russian territory. On the contrary, the presence of mountains has facilitated the internal division of Western Europe into many countries and states based on their different geographical environments. Indeed, unlike the cultural tradition that emerged in the Western world, in which the perception of time seems to be very significant, in the Russian cultural experience, space is the primary and dominant category through which to interpret and perceive external reality. Accordingly, the interpretation of space-time as a continuum suggests the dominance of the first component over the second.[1]

Along the same line, two major Russian historians of the 19th century, Sergey M. Solovyev and Vasily O. Kljuchevskij, insisted on the non-European geographical Russian space and the significance that this perception of space has had on the interpretation of the historical development of Russia. In his *History of Russia*, Solovyev described the "vast flatland" and the "enormous distance" that extends from the White Sea to the Black Sea and from the Baltic to the Caspian as a boundless territory in which a traveller may not experience any sharp distinction, any real borders, but only the cohesiveness of the landscape.[2]

1. Petr Caadaev, *Polnoe sobranie schinenij i izbrannye pis'ma* (Complete Works and Correspondences) vol. 1 (Moscow, 1991), 323.
2. Vittorio Strada, *La questione russa: Identità e destino* (Padova 1991), 131–132.

The characteristics of Russian geography made possible the development of a distinct intellectual tradition in the natural sciences, which is characterised by unique conceptions of space, time and boundaries. This uniqueness is probably at the base of Russia's impressive career in the Earth sciences, which reached its peak between the end of the 19th and the beginning of the 20th century. Such a legacy produced a particular attitude among Russian naturalists who adopted an uncommon approach to the investigation of the history of Earth and the history of Life on Earth, treating them as an integrated subject. In other words, geo-history and life-history are two parts of one system of complementary correlations regulated by the process of "co-evolution".

The work and ideas of the physician Alexander A. Malinovksy, alias Bogdanov (1873-1928), is a particularly interesting example of this intellectual legacy in which the dominance of space over time co-exists with a co-evolutionary and historical approach. Bogdanov proposed a systemic perspective on nature, cognition and society long before Norbert Wiener's Cybernetics and Ludwig von Bertalanffy's General Systems Theory appeared in the second half of the 20th century.

The General Science of Organization: Tektology is a 3-volume book in which Bogdanov provides some basic principles for understanding nature as composed of parts that continuously interact by means of dynamic *organisation*.[3] Here, tektology should not be confused with cybernetics. *Kibernetes*, which means "steersman", the term that Wiener used as a metaphor for "control" or "governor", refers to the rules according to which one can govern any regulatory system, their structures, constraints or possibilities through the use of technologies. Tektology, instead, from the Ancient Greek noun *tektōn* (τέκτων, which means "craftsman"), whose verb means to create, build or produce, emphasises the constructive, organisational aspect of systems' activities, placing more emphasis on action than on subjection to control.

Mainly inspired by a Darwinian evolutionary perspective, by Wilhelm

3. Alexander Bogdanov, *Vseobshaja organizaionnaja nauka: Tektologija*, ed. L.I. Abalkin et al. (Moscow, 1989).

Ostwald's energetism and by the monistic theories of Ludwig Noire, Bogdanov's general organisational science was concerned with structural regularities, general types of systems, the general laws of their transformation and the fundamental laws of organisation of any elements in nature, practice and cognition. Tektology was one of the first attempts to produce a systematic formulation of the principles operating in both living and non-living systems. Bogdanov preferred using the term "complex" over the term "system". In his view, "complex" emphasises the dynamic aspects of its behaviour while "system" is a spatially closed entity with a self-supporting structure. For this reason, systems seem to have static properties that are not influenced by time. However, according to Bogdanov, the movement and change of the environment, meant as a complex composed by a myriad of interacting parts, can be rightly understood only if a historical point of view is adopted.[4]

Physical, chemical, biological, social, ecological, planetary and cosmological systems are contemplated in this overarching organisational theory based on specific notions such as self-regulation, conjugation, selection, feedback, complementary correlation, assimilation and disassimilation, convergence, divergence, crisis, and co-evolution. Any natural system, independently of its scale—it could be an atomic-scale system or a supra-anthropic scale system—accords to some basic principles, and has to be analysed from the point of view of its internal organisation and its constitutive relationship with the environment. The latter is conceived as both biotic, thus including other biological systems, and abiotic, that is, the physical and chemical environment.

As Bogdanov pointed out:

> We already know two important things about the preservation of complexes: first, their preservation is never absolute and is always approximate only; second, it is the result of a dynamic equilibrium of the system with its environment, i.e., it is created by the two flows

4. Alexander Bogdanov, *Osnovnye Elementy Istoricheskogo vzgliada na prirodu* (St. Petersburg, 1899), 10. See also, *Poznanie s istoricheskie tochky zreinja* (St. Petersburg, 1901).

> of activities: the absorption and assimilation of activities from outside, and the dissimilation of activities, their loss or transfer to the external environment. And this means two uninterrupted and parallel series of processes of progressive selection, both positive and negative. They can equalize quantitatively, with fluctuations in this or that direction, but each, as we have already seen, performs by its very nature a special tektological role and has a special influence on the structure of a system. Together they both regulate its development.
>
> In what direction do they regulate this development? Obviously, in the direction of the most stable correlations since the less stable correlations must be gradually eliminated, and the more stable are strengthened by positive selection.
>
> At the same time, this development, it should be remembered, is achieved through divergence, inasmuch as parts of the whole possess separateness. In this way *differences grow, leading to increasingly more stable structural correlations*.[5]

According to Bogdanov, systems are evolving organisations of elements that are not reversible as they evolve over time. The environment plays a constitutive and constructive role in the evolutionary process of systems. Plasticity is, therefore, an essential feature of tektological complexes which can be analysed as evolving unities thanks to the continuous exchange of matter and energy with the environment. A system under development involves an environment under development.

Bogdanov's theory of tektological organisation not only was pioneering for it anticipated concepts that were to become crucial to systems theory and cybernetics. But, even more interesting, it offered an explanation of the plurality, scales and complexity of systems belonging to different organisational levels: from particles to biological

5. Alexander Bogdanov, *Essays in Tektology, the general science of organization*, ed. G. Gorelik (Intersystems Publication, 1984), 127–128.

communities, from ecosystem to societies, from the biosphere to the earth-system. And in this sense, Bogdanov offered insights towards the early formulation of system and planetary ecology, both scientific perspectives that study how communities of organisms, including human societies, interact with specific ecosystems at different steps of the food chain, and with the entire planet, to keep stable conditions for their existence. Some of Bogdanov's ideas were even anticipatory of James Lovelock's Gaia hypothesis, the theory of the Earth as a living organism that played a role in the development of Earth System Science in the 1980s.

As Bogdanov pointed out:

> The entire realm of life on earth can be considered as a single system of divergence, based on the rotation of carbon dioxide. This rotation forms a basis for complementary correlations between life as a whole—the "biosphere"—and gaseous cover of the earth—the "atmosphere". The stability of atmospheric content is sustained by the biosphere, which draws from the atmosphere the material for assimilation.[6]

According to Milan Zeleny:

> Bogdanov coupled biosphere, atmosphere, hydrosphere, and lithosphere into a single holistic system of mutual co-evolving influences: a result of evolution through systemic divergence. Complementary correlations between the big segregated groupings of elements of the Earth's surface have evolved over hundreds of millions of years by a long series of processes of selections.[7]

However, Bogdanov went probably much further than Lovelock did by boxing life on/and Earth into an overarching cybernetics system of self-organisation. Bogdanov argued for a polymorphic concept of the environment, which he considered neither empty physical space waiting to be occupied by evolving living organisms nor a collection

6. Ibid., 130.
7. Milan Zeleny, "Tectologia," General System, 14 (1988): 331–343.

of structural conditions that determine uni-directionally the life of the community.[8]

This polymorphic idea does not apply only to biological organisms different from human beings. Indeed, in Tektology there is a clear attempt to consistently address the long-term process of co-evolution of human communities and the biosphere. After all, the Anthropocene, the new geological epoch proposed by Paul Crutzen in 2000 to describe the all-encompassing impact on humanity on the earth's geology, does not start after the Holocene for the Russians. Instead, it coincides with it. Indeed, the most critical steps of human evolution can't be limited merely to the 19th or the 20th century, when the accelerated dynamics start. We have to explore at least the last twelve thousand years to deal with the Anthropocene.[9] Russians believe that a careful review of all past attempts to make sense of the human-environment nexus must be considered, and only a perspective based on the *longue-durée* of both human and global history could enable such a profound historical account. In this sense, spatial dynamics and human temporalities become deep, ramified, and integrated, losing the character of linearity, separateness and predictability that characterises Western progressivist narratives.

8. Giulia Rispoli, "Sharing in Action: Bogdanov, the Living Experience and the Systemic Concept of the Environment," in: *Culture as Organization in Early Soviet Thought*, ed. P. Tikka et al. (Aalto University, 2016).
9. Mark Maslin & Simon Lewis, *The Human Planet: How we Created the Anthropocene* (Penguin, 2018).