III. Science and Economics

Vernadsky's Economic Space and Time: The Anti-Entropy of the Noösphere

by Jason Ross

This is the edited transcript of Jason Ross's presentation to Panel 1, "Vernadsky's Revolution in Science and Thought," of the Schiller Institute's Nov. 12, 2022 online conference, "The Physical Economy of the Noösphere: Reviving the Heritage of Vladimir Vernadsky." Mr. Ross is Executive Director of The LaRouche Organization, and one of the central people with whom LaRouche worked over the last decade of his life to rediscover and circulate the work of Vernadsky.

The full conference video is available on the Schiller Institute website.

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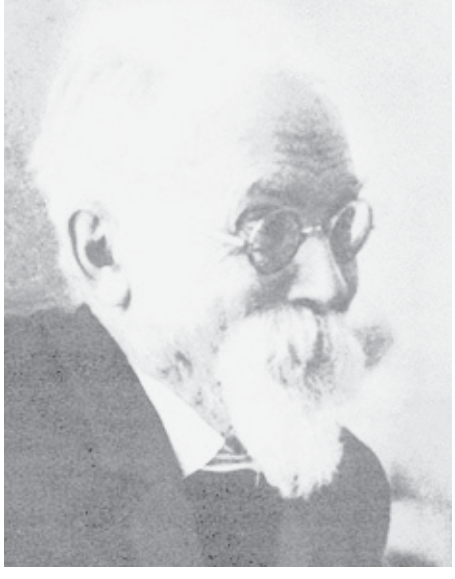
Jason Ross

I'm happy to join this really excellent panel. I want to start by recalling some of the work that we have done on bringing Vernadsky into the consciousness of Americans, and people around the world. The anthology produced in 2014 by *21st Century Science & Technology* for the 150th birthday of Vladimir Vernadsky was published in two parts: Volume 1, *The Biosphere*, and Volume 2, *The Noösphere*. We published the first English translation, by Meghan Ogden (née Rouillard), of one of the works that Vernadsky had published in 1930 in French, "The Study of Life and the New Physics." I'm going to use some of that as the basis for what I'm going to talk about today.



Vladimir Vernadsky (1863-1945)

There exists a profound coherence between the economic and scientific ideas presented by Lyndon LaRouche, and the concepts of biosphere and noösphere as developed by Vladimir Vernadsky, the great Russian scientist of Ukrainian heritage. This connection is of profound importance for countering the Malthusian "green" suicide cult, and for charting a course of economic growth to completely eliminate poverty and increase economic output by an order of magnitude.

Lyndon LaRouche speaks of the source of value in an economy as lying not in money, but also not in material production itself; the source of economic value is the ability of human beings to make discoveries of universal principle and implement those discoveries, socially, to achieve an increase in mankind's power over nature. This is measured in an increase in what would be called the "carrying capacity" if we were animals, but is better described as the potential population density of the human species. It is also measured as an increase in the density of application of energy in human economy—what LaRouche calls energy flux-density.

Three Phase Spaces

To see the parallels between these two thinkers—LaRouche and

Vernadsky—let's consider the distinctions Vladimir Vernadsky made between three phase spaces: the abiotic, the biological, and the cognitive.

These are phase spaces that include their own proper principles. The biosphere is not only living matter itself; it extends into the crust of the Earth and to the limits of its atmosphere, by virtue of the action of life to change the chemical composition of the lithosphere. The noösphere is the human race and its reshaping of the Earth and beyond. Biology has had an increasingly powerful impact on the lithosphere. And human cognition has grown even more profoundly to have an increasingly powerful impact on both.

Although many assume that biology must be nothing more than physics, and that cognition is at its foundation a biological process, this reductionist approach has not been demonstrated, has not been proven. This reductionism is simply an axiom, a tenet of faith.

Biology follows laws of physics, but is not fully explained by them.

Music is conveyed with notes, but is not contained within them. Music is not composed of notes.

Ideas are conveyed with words, but the words are not the idea. The process of *discovery*, and of communication, is inseparable from knowledge.

Cognition occurs in a biological substrate and is affected by that biology, but is not only biological.

Contrast human creativity with what is called machine learning. There is a oneness of conception in a human hypothesis that is not found in the millions or billions of parameters of a machine-learning system. We hypothesize causes, which have an existence that is opposite to a correlation of data, of sense impressions.

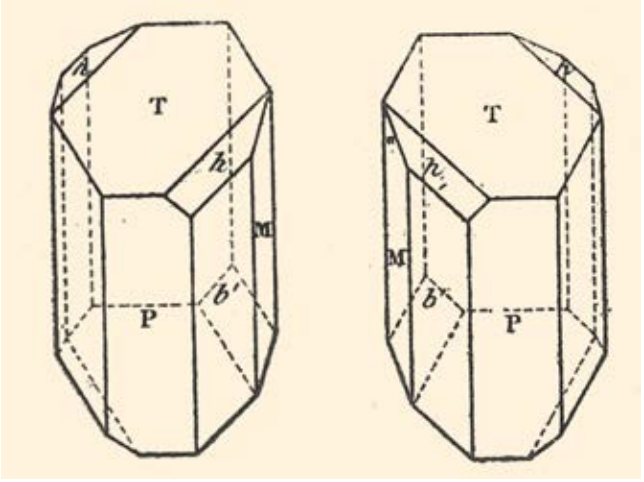
Human thought is not logical. It cannot be performed by a computer.

The Arrow of Time

To draw out the differences among Vernadsky's phase spaces—the abiotic, the biological, and the noetic—I will focus in the rest of this presentation on one particular example: the nature of time in these phase spaces, with particular emphasis on the arrow of time. Why does time flow in one direction and not the other?

Start with a similar, analogous example in geometry—the difference between left and right.

In Euclidean geometry, there is no directly stateable difference between left and right. They are simply opposites. You cannot define left in a purely geometric way. (That is, without referring to which side of the body the heart is located on, for example.) Left is not-right, and right is not-left, but geometrically you cannot say what either of them is on its own.



The chiral—right-handed and left-handed—forms of tartaric acid crystals ($C_4H_6O_6$). Louis Pasteur found that only the left-handed form occurs in living things, such as fruits. But in laboratory synthesis, the two forms are produced in equal amounts.

Yet in biological space, there are many molecules that exist as mirror images of each other, called enantiomers (stereoisomers). Amino acids, with one exception, exist as one chiral form, but not the other. Here left and right most certainly do differ in another way!

Vernadsky sought a new form of geometry capable of comprehending this difference. But what if abiotic geometry simply cannot fully comprehend biological geometry?

From geometry we return to time, to look at past and future as we looked at right and left.

In the abiotic world, dynamic physical laws have no direction of time. Time passes, but the formulas work exactly the same whether they move toward the future or the past. If you have a differential expression for the evolution of a physical system, does it matter whether ***dt*** is positive or negative? We can run our projections forwards or back, either predicting the future path of a pendulum, or recreating its past motion.

But there do exist thermodynamic laws of physics that do have a direction in time. That time is related to what is called entropy, a measure of the amount of energy that is unable to do work—sometimes called (incorrectly) a measure of disorder. This arises, for example, in the flow of heat from higher to lower temperatures.

If I play a video of planets orbiting a star, you wouldn't know whether the video is going forward or backward. But if I show a video of a cup of tea in which an ice cube forms while the liquid gets hotter and hotter, you'd conclude that the video is being run backwards.

Unlike the video of planets, or the equivalence of left and right in geometry, the heat-related process clearly has only one direction in time.

Briefly, the idea of entropy is that over time, systems move toward states with more ways of being. There are more ways to arrange the molecules of a cup of tea—more states—for a warm cup of tea than a hot cup of tea with an ice cube. There are more ways to have air spread around a room than there are ways of having it all condensed in a bottle in a corner of the room. If you open a compressed air tank, the air will escape, but it never goes back into the bottle *en masse*.

Move now to biology.

In biology, there are several types of time—metabolic time (think of a few hours—you eat food, move your body, excrete waste, breathe out CO_2), generational time (reproduction), and evolutionary time (tens of millions of years).

The direction is clear. Over generational (or reproductive) time, trees as a group can move across a landscape, even though an individual tree doesn't walk in metabolic time.

Over evolutionary time, life doesn't just "change"; it's not just "different." It changes in a specific way—it *advances!*

This can be measured in the number of elements used by life.

This can be measured by the flow of material and energy.

Vernadsky considered this a biological principle.

As an example, per [unit of] body mass per lifespan, mammals, on average, use much more energy than reptiles. Mammals have additional specialized processes, made possible by their endothermy—their controlled temperature. A process of cephalization has seen a concentration of nervous processes in the head, including the brain.

Unlike in abiotic, thermodynamic processes, where the arrow of time points to states of greater *probability*, in evolutionary time, the arrow points towards states of absolute *impossibility*, of new biological "technologies" that simply did not exist before. Chemotrophs living off of sulfur emitted by hot vents in the ocean floor cannot photosynthesize, but now we have an atmosphere that is one-fifth oxygen! Photosynthesis caused immense changes in the atmosphere, crust, and oceans.

With these changes, for life, past and future are not just opposites, like left and right in Euclidean space, or a positive or negative ***dt*** in dynamical physics. For life, the future reaches states that the past never could have!

How about cognitive time?

For us, think through the extremely different experiences of past and future, and also of the now. Can you remember the future? Can you change the past? What is "now" in your experience, and how does it differ from any other moment in time, from any "then"?

I ask: do rocks have a "now"? If there weren't people expressing our free will, how would some "then" differ from "now"? Does a rock know the difference between now and ten minutes ago? *Without cognition, does such a difference even exist?*

Is there a "present" without us? What makes "now" now, if not free will?

Or is "now" an aspect of time that exists only for the noösphere?

Let's look at biology and cognition.

The Increasing Independence of Life from Its Surroundings

Life has become increasingly independent of its surroundings, such as by using the distant Sun for energy, rather than chemicals in the immediate environment.

Life has increasingly shaped its surroundings. (This is the kernel of the Gaia hypothesis of James Lovelock and Lynn Margulis.)

Humans bring into being new synthetic environments through the infrastructure platforms we create. This is how Lyndon LaRouche saw economic infrastructure—not as a collection of pieces of rail and roadway, but as representing a certain level of technological understanding and social direction. An economic platform changes the physical space in which economic processes unfold. It creates an environment, like the endothermic environment of mammals, in which new economic processes are possible.

But unlike all other life, we create these epochal changes in a moment, in the twinkling of an eye, when a fundamental discovery is born or communicated. We

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Life has increasingly shaped its surroundings. Humankind brings new synthetic environments through the infrastructure platforms we create. To improve our productive abilities, we create and use more energy, more resources per person. Shown: an earth-moving machine and a laser for precision cutting.

embody in our minds, a process that takes the mere biosphere millions of years.

We are endowed with a "now" that allows us to change the future—and also the past, by drawing meaning from it. *That process of change is the truest substance of the universe!*

In improving our economic abilities, by increasing our power over nature, we use more energy, more resources per person. And that is good! We also create more resources per person. We create energy. The laws of thermodynamics do not apply to human economy as a whole.

I conclude: We have a role, as the only known form of cognitive life in this universe, to expand the process of development initiated by the abiotic universe, the formation of the solar system, the development of the biosphere, to create a more prosperous, joyful, beautiful, and purpose-drenched human society. Such efforts will bring a measure of justice to the past and future of the lives of Lyndon LaRouche and Vladimir Vernadsky, among the billions of people who have lived and who are yet to be born.

Nicholas of Cusa (1401-1464) maintained the primacy of the process of discovery itself. Contradictions drive the mind to hypothesize new concepts, not derivable from past paradigms.

Anti-entropy, growth, is our mission!

I close by quoting the conclusion of a paper I wrote, "Vernadskian Time—Time for Humanity," which appears in the Schiller Institute's online magazine of art, science, and statecraft, *Leonore*, Vol. 2, No. 1, 2022.

> [Cardinal Nicholas of] Cusa (1401–1464) maintained the primacy of the process of discovery itself, whereby contradictions drive the mind to hypothesize a new concept, not derivable from the past—a conclusion that defies the premises, rather than following from them. Cusa held that it was through this process, of knowing through specific ignorance, that one could come the closest to seeing God. Resolving paradoxes through developing new metaphors for understanding is more than a technique for arriving at physical truths: This process is the truest substance of nature.
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> Every human being is born with the potential to apply this process of discovery: to exist in the efficient immortality of discovering principles and applying them for the betterment of society, where betterment is seen in increasing the capability of fellow human beings to participate in this most characteristically human of behaviors.
>
> The creation of such a society, free from the oligarchism that currently threatens global thermonuclear warfare, is the most beautiful, the most human, and the most urgently pressing task facing mankind today.