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"Novum Organum: The Reckoning of Unattended Dialectics"

Author(s):

Alexander Maslov, Bagwell Center Affiliated Faculty

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Alexander Maslov

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During the last several decades the world has changed drastically. Some say that we witness "the crisis of humanity" (Max-Neef, 2010), others — "the end times" (Zizek and Žižek, 2011). While the direness of the plight may be exaggerated, with every passing day fewer refuse to acknowledge the fiasco of mainstream neoclassical economics, even though it is still prevalent in much of the conducted economic analysis (Anderson and M'Gonigle, 2012). There is a glimpse of hope that the next several decades will be characterized by an endured shift in "normal science" or "research program" advocated by prominent post-positivists (e.g., Feyerabend 1978; Lakatos et al. 1979; Kuhn 2012). It should be noted, however, that these philosophers of science were ruminating over shifts in natural sciences. As fairly noted in Yefimov (2011a) and Yefimov (2011b), such shifts may be inapplicable to economics since the latter is more of a social project, which possesses a different enforcement mechanism of beliefs and convictions (Peirce, 1931).

Unlike natural sciences preoccupied with matter or pure social sciences concerned with psyche in the broadest sense, economics deals with both essences in the form of goods as transformed energy from the physical realm of nature and socially-compelled interactions arising around them. In this regard, Georgescu-Roegen (1993) fairly defines entropic indeterminateness, which encompasses the aforementioned dialectics, and identifies obstacles in the analysis of evolutionary changes. However, economy is an open system, which allows it to avoid the pending doom of the second law of thermodynamics by transferring the accruing chaos within to adjacent systems. I believe that the ontological and epistemological dialectics of economics is of far greater concern than the thermodynamic one pertaining to actual economies. The latter was also more broadly characterized by the famous Russian philosopher Nikolai Berdyaev: "The world will perish from inexorable and unhinged pursuit for physical equality, but isn't this yearning for equality in the social world the same entropy, the same demise of social cosmos and culture within the uniform distribution of the heat energy, irreversible into the energy creating culture?" (Berdyaev, 2005).

Neoclassical economists use explicit functions of utility in their models, while their own function of social utility remains implicit. At times, even economists themselves are

discombobulated and have a hard time finding their purpose. Anecdotally, this confusion never occurs in natural sciences when even a high school student has a solid understanding of what physics or chemistry is about. Perhaps, one of the most apt descriptions of what economists really do was given by Dr. Ariel Rubinstein: "Yes, I do think we are simply the tellers of fables, but is that not wonderful?" (Rubinstein, 2006).

There is extensive literature unraveling a panoply of fundamental pitfalls, which neoclassical economics is based on: some were argued many years ago by non-orthodox economic schools using the same ontology and epistemology (e.g., Nelson 2009; Hayek 2013). Another plateau is represented by different ontology and epistemology of social constructivism, which pivoting elements are in-depth interview (e.g., Kaufmann 2011), valid theory (e.g., Charmaz 2006; Bryant and Charmaz 2007; Dey 2012), and action research (e.g., Stringer 1999; Bradbury and Reason 2006; Greenwood and Levin 2006; Craig 2009) used by a number of scholars both indirectly (e.g., Baker 2009; Akerlof and Shiller 2010; Shiller 2012) and directly (e.g., Degnbol-Martinussen 2001; Yefimov 2003; Bewley and Bewley 2009; Abolafia 2010) to show the efficacy of an alternative qualitative approach to social realities.

It is not a secret that the emergence of universities was linked to desperate needs of the Catholic Church, civil authorities and governing classes for educated people to administer their activities. First universities depended heavily on temporal powers, i.e., kings, but the crucial support originated from the popes (Charle and Verger, 1994). The system of the university education was scholastic: it was based on medieval and ancient authorities and rigorously guarded from alternative ideas born outside. The emergence of economics as a "science" occurred during the triumph of Newton's mechanics, when fundamental laws of mechanical systems seemed to have superseded gods and deities from different cultures previously deemed indispensable in describing regularities of our accustomed macroscopic world. The founding fathers of economics were fascinated by these laws and strove to replicate them for a society based on the same ontology and epistemology, since at that time these laws indeed seem to be the "equations of everything". Of course, it was later discovered that Newton's laws of motion fall apart in the microscopic world of elementary particles. However, it was too late because of the founder's effect — the axiomatic framework of economics has already taken its roots and institutionalized corresponding ontology and epistemology. This legacy has shown extraordinary persistence, commensurate with that of dominating religions in the world.

An important element of criticism comes from our own peers due to similar training and perception of the economic reality. Even before the financial crisis of 2007-2008, some economists (Rubinstein, 2006) warned about the aggravating inconsistency of economic models with the real world:

«. . . As in the case of fables, absurd conclusions reveal contexts in which the model produces unreasonable results, but this may not necessarily make the model uninteresting. As in the case of fables, models in economic theory are derived from observations of the

real world, but are not meant to be testable. As in the case of fables, models have limited scope. As in the case of a good fable, a good model can have an enormous influence on the real world, not by providing advice or by predicting the future, but rather by influencing culture...».

A few years after the unprecedented collapse of the financial bubble (July 2010), during one of the hearings hosted by the United States Congress on failures of macroeconomic modeling, Dr. Robert Solow pinned down the major shortcomings of the implemented models as follows:[1]

«...They [economists] take it for granted that the whole economy can be thought about as if it were a single, consistent person or dynasty carrying out a rationally designed, long-term plan, occasionally disturbed by unexpected shocks, but adapting to them in a rational, consistent way...».

Dr. John Taylor fairly noted that economists had not only overlooked the bubbles, they virtually facilitated their creation and collapse (Taylor, 2009):

«...It was mainly government intervention that created, prolonged, and has dramatically worsened the crisis. Firstly, the Fed's monetary strategy kept its target interest rate too low for too long, especially in the 2003–2005 period, creating monetary excesses, a main cause for the economic boom. Then, once the crisis started in mid-2007, the policy makers prescribed the wrong treatment, providing more liquidity via the Term Action Facility in December 2007, followed by the Economic Stimulus Act of 2008...».

Incorrect policy advice obviously stems from the system of economic education. In North America, economists learn neoclassical concepts in the first-second year of their undergraduate programs. All subsequent education is aimed at reinterpreting the same ideas at a more sophisticated level of mathematical aesthetics. Thus, the system trains good mathematicians, but poor economists, who treat economies from absolutely irrelevant concepts of the "natural world" and the ideal realm of mathematical models, awkwardly and recklessly applied to social realities: convergence, constrained optimization, equilibrium, efficiency, dynamic programming, rational expectations, etc.

In the best tradition of the New Time, the approach of economists is based on the interconnection of "researchers", "ideas and theories", and "objects of research", while various binding specifications are defined by rationalism, empiricism and idealism. One of the most important features of the New Time scheme of research is individualism: a researcher is lonely in his search for the truth as a copy of reality. This view defines the fundament of the scientific approach (Gower, 2012), which main criterion is falsifiability (Popper, 2013). The latter is justified within the traditional classical comprehension of science when a fact cannot be perceived without a theory, but do economists really need theories? A similar question is asked by Dr. Rubinstein (Rubinstein, 2006):

[1] https://www.govinfo.gov/content/pkg/CHRG-111hhrg57604/pdf/CHRG-111hhrg57604.pdf

«...I have the impression that as economic theorists, we hope that regularities will miraculously emerge from the formulas we write leisurely at our desks. Applied economists often feel the need for a model before they mine data for a pattern or regularity. Do we really need economic theory to find these regularities? Would it not be better to go in the opposite direction by observing the real world, whether through empirical or experimental data, to find unexpected regularities? Personally I doubt that we need preconceived theories to find regularities...».

In a similar fashion, Nobel laureate Dr. Paul Romer discusses the pitfalls of contemporary macroeconomics and compares the features of its apologists to the list created by Smolin (2007) to describe string theorists. Here is just a couple of examples: tremendous self-confidence; an unusually monolithic community; a sense of identification with the group akin to identification with a religious faith or political platform, etc. Dr. Romer continues (Romer, 2016):

«...The conjecture suggested by the parallel [string theorists vs macroeconomists] is that developments in both string theory and post-real macroeconomics illustrate a general failure mode of a scientific field that relies on mathematical theory. The conditions for failure are present when a few talented researchers come to be respected for genuine contributions on the cutting edge of mathematical modeling. Admiration evolves into deference to these leaders. Deference leads to effort along the specific lines that the leaders recommend. Because guidance from authority can align the efforts of many researchers, conformity to the facts is no longer needed as a coordinating device. As a result, if facts disconfirm the officially sanctioned theoretical vision, they are subordinated. Eventually, evidence stops being relevant. Progress in the field is judged by the purity of its mathematical theories, as determined by the authorities...».

One of the repercussions of the above predicament is the emergence of Modern Monetary Theory (Mitchell et al., 2016), which essentially claims that the government can print as much money as it wants without any consequences. These ideas have organically weaved into the radical left agenda that current Democratic party preaches and resulted in abnormal levels of inflation putting the US economy on the verge of stagflation and even depression. This is a direct result of economists frequently borrowing their methods from natural sciences, but as in the case of "Samuelson Lighthouses" (Coase, 1974), failing to do proper research beforehand.

In physics, for example, central theoretical models were developed many decades ago, and only recent advances in technology have allowed to empirically test them. In economics, almost every empirical result craves for a unique model explaining it, which creates a kaleidoscope of contradicting theories revolving around specific time-space dimensions of the social universe. One might argue that economic models are applied to real data, but the latter is not an analogy of an experiment from natural sciences: any manipulations with data beyond its descriptive characteristics are also a set of assumptions, which obviously cannot be used to verify other assumptions. In addition, unlike natural sciences, it is impossible to

completely separate the object from the subject of the analysis. Testing a model in economics is the same as testing the model of internal-combustion engine in physics by looking at how many cars successfully drive on the streets. An interesting story typically creates causal inference, but just as with fables, stories do not provide a manual for a good policy but rather influence culture. Consider another example: macroeconomists collate the aggregate consumption in a country with income and proclaim that this relation proves the permanent income hypothesis or the optimal path of consumption along the solution to consumers' constrained optimization problem. These statements are logically correct, because a utility function is an imaginary construct, which can be easily grounded on indirect evidence and adjusted according to concurrent needs. However, in reality, there is no direct way (as in natural sciences) to verify whether this argument is true, which violates the principle of falsifiability (Popper, 2013).

Neoclassical economists endow consumers with homogeneous, additive and immutable functions of utility without recognizing discourse-specific human behavior. In economics, an object must resist what a researcher thinks about it (Yefimov, 2011a). Today, it is clear that human actions are heavily influenced by biology and psychology, institutionalized and enforced by internal and external incentives. Conditional on the "module" that takes charge of the primordial machinery of our hypothalamus as a response to the stimuli from the environment, it is possible to observe mutually exclusive preferences in different contexts from the same choice set. The fundamental neoclassical axiom of revealed preferences thus collapses.

Another example of the unreasonable ineffectiveness of mathematics in economics (Velupillai, 2005) is the ergodicity assumption, i.e., the belief that future outcomes are a part of the distribution observed before. Consider a simple example: in the physical realm, the toss of a fair coin has only two immutable outcomes, which have not changed since the time of the first mint. Economists base their analysis on the assumption of similar applicability of the probability distribution to social reality. However, the probability distribution for a coin toss is conditional on the characteristics of the Minkowski space-time (Sorli et al., 2011), which is relatively constant: we can study its features, derive constants and use them as anchors in our analysis. A society, on the other hand, is incredibly fickle. We can think of a society as an infinite number of time-space dimensions, fixed at any point of observation with unknown features. Hence, if someone tries to toss an "economic coin", it might not even receive an impulse as an integral of force with respect to time, since the latter are the features of our accustomed reality. It may also evaporate, if the atmosphere contains an unknown element, neutral to people, but cindering the metal of a coin gaining momentum. The set of potential outcomes is infinite and thus truly uncertain. Many years ago, Friedrich Hayek used a similar rationale in his description of the unparalleled power of market competition: "One cannot predict the results of a competition, because the possibility of the former is exclusive with the definition of the latter" (Hayek, 2013).

Aforementioned constants play a crucial role in understanding immanent differences between known matter and the society. In fact, only constants, not patterns of data, reflect regularities, which Dr. Rubinstein talked about. Compare, for example, "state-of-the-art" economic dynamic stochastic general equilibrium model (DSGE) pretending to describe and explain all interactions in an economy and "state-of-the-art" physical Standard Model, incorporating electromagnetic, weak and strong nuclear interactions. The latter model is based on strong fundamental constants (e.g., speed of light, Planck's constant) and weak constants (e.g., masses of electrons, muons, tau leptons). DSGE models are based on assumptions about complete markets, immutable preferences of agents, rational behavior of firms, stylized shapes of production and utility functions, etc. Assumptions that have already failed the test of reality, but remain prevalent in the economic analysis. Moreover, Standard Model describes only five percent of the Universe. Recall, that ninety five percent of the Universe is assumed to consist of dark matter and dark energy. Standard Model does not try to model the interaction of antimatter based on the assumptions about its features. It indirectly incorporates them to extend a theoretical model based on experiments. Conversely, DSGE models aim to describe the whole economy using assumptions about its "matter". No wonder why it produces unrealistic results and poor if not detrimental advice for macroeconomic policy.

Every model in physics is anchored to the reality by constants – values, which have been received experimentally. Without constants, a model is anchored to subjective assumptions, which are no better than imagination. Because there are no constants in economics, every model is anchored to imagination. In this regard, Dr. Rubinstein fairly notes that "...the word 'model' sounds more scientific than 'fable' or 'fairy tale', although I do not see much difference between them... Being something between fantasy and reality, a fable is free of extraneous details and annoying diversions..." (Rubinstein, 2006).

Neoclassical economists have saturated economics with numbers, but at times their purport is dubious. In physics, the application of complex numbers to electrical circuit systems is useful, because while simplifying the model calculations it allows sustaining a level of realism by providing precise forecasts of required features of the electrical current. Macroeconomists ignore the latter, substituting similar predictions by a set of theoretical assumptions, which sustain a level of surrealism by providing precise forecasts of imaginary features of fictitious economies. For example, some popular macroeconomic models use continuous time and the maximum principle to find the steady state of an economy. While the application of Hamiltonians does have some mathematical aesthetics, provoking reverence in the eyes of uninitiated, it cannot make even the most general predictions about the dynamics of real economies. Thus, complex mathematical tools create a mere pantomime, dressing up a fable and transforming it into a "model". On the bright side, this whimsical juggling of numbers and mathematical theorems in the gust of revelation is indeed a good foundation for intriguing and educative fables, which do influence culture.

Consider the following allegory. Imagine an individual, who is learning Kung Fu by watching movies and mimicking the actions he sees on the screen. He is resolute in his belief that this imitation makes him a great fighter. It is not hard to predict what would happen to this individual if he was to participate in a real street fight — he would be beaten and humiliated. What is difficult to imagine is that instead of pondering the possibility that something may be wrong with his whole life philosophy, this person thinks that his failure is merely a result of him not "training" enough, and doubles down on what he was doing before. One can but wonder how many fights this individual must survive in order to understand that his ontological views and epistemological yearnings are wrong and have drifted far away from the harsh truth of reality.

The last decade has shown that neoclassical theory has failed the test of reality. In general, deductive reasoning in economics has excelled at creating fables, but significantly underperformed at predicting and explaining the reality, which has been shown even by the most prominent representatives of the neoclassical school. Why do we contemplate such persistence of a failed "normal science" in economics when there is a succession of paradigms in natural sciences in accordance with the inability of the dominant theory to explain observed features of the reality (Kuhn, 2012)? The reason for that, as noticed before, is in drastically different grounds for sciences. Emerging from the theological agenda of medieval universities, economics has inherited the same sacral foresights into the structure of this world, and to this day, we are still able to observe the inability of economists to resist the luring aesthetics of numbers, which, by an enigmatic way, stack into grotesque patchwork of captive logic cringing before triumphant revelation.

Albert Einstein once said that we cannot solve our problems with the same reasoning we created them. Neoclassical economists believe that all "economic troubles" come from imperfectness of their models and by building a more sophisticated mathematical model, they will finally be able to solve them. However, we have already discussed the fundamental flaws of mathematical economics: whether an economic system is described by one equation and few variables, or a system of equations with hundreds of variables — it does not matter, it is still the same deductive reasoning, which has failed the test of reality.

Which ontology dominates neoclassical economics? In the beginning, I wrote about two major elements of the traditional view of scientific research, when there is an object of investigation and a researcher with ideas (theories). Interactions among these elements occur conditionally on the epistemological veil of empiricism, idealism and rationalism. Despite certain differences, all of them appeal to the same view of scientific research shared within the New Time. Such words as "law" and "mechanism" were the pivoting elements of that time, but more importantly, a researcher was alone in searching for the truth as a copy of reality (Gower, 2012). Such hypothetically-deductive methods and the corresponding reality they draw on construe Newtonian ontology and epistemology (giving credit to the analogy of the mechanistic view of the world). It coincides with the deductive yearning of

neoclassical economists to model an economy as a mechanistic system with its axioms, laws and theorems. It is obvious that such analogies were inherited from the natural sciences of that time, in particular — classical physics. However, while anything in the world of matter is created for some purpose, or an end to something, a society, let idealistically, is a kingdom of ends, where every individual is an end to itself (Kant, 2013). This difference is crucial in understanding the impossibility of applying not just the same methods of research and analysis to the society (as those used in natural sciences), but even approaching it from the same ontological and epistemological perspective. Being an end to itself, an individual is free in a sense of a bound necessity. This vital feature resurrects disregarded by neoclassical economists innately and socially acquired characteristics of a human being — language, emotions, mentality, traditions, etc, which are most generally incorporated into discourse. The analysis of discourse can reveal true conscious and subconscious motives and incentives of people. Such an approach can be said to be grounded in Kant's ontology and corresponding epistemology.

While Kant's ontology fits the social world much better than Newton's ontology, an economic system is somewhere in between the realm of matter and psyche, because it is a system of social interactions in regard to goods, which are produced from nature. Hence, neither of the above ontologies can capture the unique characteristics of economies, where some energy is transmitted into the society (according to the laws of thermodynamics), but gets disturbed within it. Before becoming obsessed with utopian ideas of communism, Karl Marx has seen this process as an interaction between use and exchange values (Marx, 1981). Use value reflects the energy of a good, which is the result of labor exerted by nature and people, while the exchange value is its market valuation. Just as the original ideas about an economic system were heavily influenced by the dominating view of the world at that time, Marx's perception of the world has not escaped the same bane. It has been shown how Marx's analysis was influenced by the jubilant ideas of thermodynamics in the nineteenth century (Bellamy Foster and Burkett, 2008). While the impact of the latter could not have been avoided by the sense of that time (just as in the case of neoclassical economics and classical physics), thermodynamic laws in the social world indeed have found much more evidence than those of classical physics.

By now it is clear that economics cannot be a standalone science. It is too deeply intertwined with both nature and people's psychology. As a result, economics should find such a domain, which would take into account not only the social institutions and ethnographic characteristics of the interactions among people, but also the imminent energy coming from nature. One approach could be via social entropy: each natural resource contains certain energy reflected in the amount of positive work that can be done over it — exergy. Some exergy is renewable, some — not. When consumed, exergy creates order, which is bound to dissipate with time according to the laws of thermodynamics. To sustain that order, more exergy is required. One can think of exergy transmitted into the economic

system as a buffer against entropy. Thus, if the amount of exergy does not correspond to created order, the innate entropic processes will adjust the system to a lower level of order corresponding to the transmitted exergy from the external system. Why societies should be different? For example, financial markets could be deemed as order created from the exergy of the society — when the amount of order exceeds the exergy received from the society, a crisis happens. This is just one way to think about how biosphere transforms into noosphere (Vernadsky, 1977).

Another approach could be based on the convergence of evolutionary psychology and institutional economics. A human's mind is a result of natural evolution. It has been developing its reactions to the stimuli from the environment hundreds of thousands of years before the inception of civilization. It is obvious that relatively minuscule period of time of social evolution could not have debugged and rewritten the solutions engraved into the human's mind by the nature itself. Despite rampant technological progress, our modern skulls still house a stone age mind, which has been the leitmotif of the modular theory of mind (e.g., Barkow et al. 1995; Cosmides and Tooby 2013). Application of evolutionary psychology to studying choices of people could provide a deeper understanding of the underlying mechanisms of our decisions, which were analyzed in different frameworks by economists of traditional institutionalism and evolutionary schools. For example, the famous Veblen's dichotomy (Waller Jr, 1982), or generally Veblen-Ayres framework (Street, 1987; Bush, 1987), dealing with the eternal conflict of ceremonial and instrumental values (Veblen, 1990), describes the interrelation of socially enforced modules. Such an approach could extend this analysis to naturally evolved modules and their impact on ceremonial values, describing the mechanism by which a "ceremonial module" as a social fetish of a naturally developed module gains more power with each successful short-term gratification taking subsequent leadership in humans' actions. This process was partially analyzed by Mises (Mises, 1949). Coupled with understanding of exergy and its critical role in societies, this new paradigm could be framed as Vernadsky ontology (giving credit to his idea of "noosphere"), which captures both the psyche and the realm of matter and their interactions, which constitute an economic system. I am convinced that such types of multidisciplinary approaches could lift the veil of increasing complexity of interactions among people in regard to goods and change not only the existing economic paradigm, but its very epistemological and ontological fundamentals. However, the discipline should open itself to new ideas and transform from a dogmatic theology based on faith into malleable science based on evidence.

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