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A systemic problem cannot be solved systemically

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Abstract

This paper is a short essay that claims that a systemic problem cannot be rightly understood and even less solved on the same level, in the same framework or with the same tools that entail the very same problem. This is a radical variation of Einstein's idea set out in the context of the Copenhaguen debate according to which a problem cannot be solved if we do not change the conditions in which the problem arose originally. More exactly, a systemic problem cannot be tackled and solved with tools, approaches and rods of the very same kind, level, nature of framework that define the problem. To truly tackle and solve any problem, the approach, tools, concepts, models, and the like need have a higher or heavier calibre so to speak than the problem. Otherwise, we do not solve a problem at all. At its best, we displace it. This essay argues that to solve any systemic problem a complexity endeavour is needed. Reasons for the insufficiency of systems science and about the rationale of complexity theory are provided.

Key words: problem solving, systems science, complexity theory, epistemology, world.

Introduction

Most scientists are willing to convey that there are a variety of methods and methodologies, despite the jargon about "the scientific method" and its positivistic philosophy. Yet, traditionally epistemology is taken as being unique as if it was impossible that various epistemological approaches could be compared, tested, valuated, or related in one sense or another. Epistemology is conceived as a sort of continent where many things happen and are possible -such as the valuation of sciences and disciplines, the interaction of different approaches, and the like, but epistemology remains, at least theoretically, as a non-variant stance. As if nothing occurred to the continent itself.

We live in a world of crisis; to tell the truth, of increasingly numerous crises. In general, a crisis is said to be systemic because of the serious consequences, the intricate relations it has in its own structure and dynamics as well as in relation with several other contexts and problems. Systems science is usually brought in when understanding and trying to explain the complexity of a problem. To be sure, the social sciences bear a responsibility vis-à-vis the correct understanding of the problems around including their history. Moreover, the social sciences are crucial about the possibility and the need to solve, say economic, social, political, sociological, anthropological, financial, managerial, and psychological hurdles. Certainly, it is not only a concern for the social sciences, but also for the interplay between them and the natural sciences, engineering, and the arts. In the largest but deepest sense of the word, the crises refer immediately to the wide set of the social and human sciences as follows: what are the social and human sciences that apparently cannot cope with the vast array of challenges, problems, and hurdles? Aren't the ongoing crises concomitant to an epistemological crisis amid the social and human sciences? This paper aims at answering these questions.

Given the complexity of the problems we currently identify and face, the call for cross-disciplinary takes frequently arises. More specifically, the call for inter, trans, and multidisciplinary is usually made as a strategy justified on the complexity of the problems. Such is the tenure of systems science, indeed.

Yet, the problems of the world do not just mean structural, institutional, and not even epistemological hurdles, and are not simply a matter of models and programs, for instance. After all, the base unit in the social sciences are people -in the largest, widest, and deepest sense of the world. Solving problems rightly means helping make people suffer less, and perhaps making them happier and freer, which certainly is not a minor achievement.

The heaviness of the problems has led even to speak about a civilization crisis, not just a crisis of a period, say, capitalism, neoliberalism, or the modern age. The diagnostics about the ongoing crises are indeed numerous and varied. The ongoing global problems can be truly defined as a systemic collapse of the current society, i.e., civilization. In medicine, a patient is said to be in a systemic collapse when everything ceases to work at once and a crisis in one system or level affects other systems and organs. Jared Diamond in his book *Collapse: How societies choose to fail or succeed,* rightly has written the first diagnosis of societies and history: weakening of the environment, soil problems, deforestation, water management troubles, excessive fishery and hunting, human population growth, overconsuming, social, economic, and psychological hindrances thereafter, moral, and ethical turbulence, and many other traits and aspects. According to Danilo Brozović, who has written a literature review on societal collapse: "a systematic multidisciplinary review of the existing literature (361 articles and 73 books) identifies five scholarly conversations: past collapses, general explanations of collapse, alternatives to collapse, fictional collapses, and future climate change and societal collapse" (Brozović 2023:1).

To be sure, a systemic collapse is not reduced to medicine and to the health sciences, but it pervades society and history at large. A systems or systemic diagnostics entails that it is impossible to tackle one problem without at the same time tackling others, and yet, nothing can be really done. The patient is at stake, and the best thing to be done is apply palliative care.

Being as it might be, however, an epistemological -if not also a moral imperative arises, namely systemic problems are to be solved- if possible before it is too late. Systemic problems demand henceforth a higher level, to be solved. That points out to complexity theory.

This paper argues that it is possible, indeed necessary to weigh different epistemological apparatuses. Here the focus is on weighing systems science and complexity science, for they are probably the two most important tools when assessing the state-of-the-world and seek solving its problems. This paper claims that systems science and complexity science are not equal in any sense, despite an atavistic assimilation of both. The first section studies how and why systems science and complexity science cannot be taken as equivalent vis-à-vis understanding and solving complex problems. The second section of this paper considers the way in which current global problems are indeed systemic. The third section draws attention on exactly why given the systemic character of the global problems a complex approach is needed. Such complex approach, it is argued here, is the one provided by the sciences of complexity, i.e., complexity theory. The paper ends highlighting the epistemology of complex problems and its relevance to the social and human sciences.

Weighing different epistemological apparatuses

Epistemology can and has usually been taken as a conceptual, methodological, and philosophical toolbox that helps understand and explain the world and the problems, the structures and dynamics that define it, along with the tools or rods used. Certainly, epistemology encompasses serious subjects framed in and as the history and philosophy of science, such as verificationism, justificationism, testability, falseability, demarcation criteria, metatheory, and many others. This paper highlights the pragmatic takes of epistemology; by this it is meant here the balance of different epistemological approaches.

In this sense, this paper focuses on the relationship between systems science and complexity theory. The reason lies in the wide use of them in the specialized academic literature as well as among decision-makers in general, nearly at all levels when diagnosing and trying to solve the most crucial global problems. There is, though, as it happens a confusion between both scientific approaches. Tracing delimitation criteria between them is a subject that remains out this scope. Instead, weighing them results as a more convenient way to rightly evaluate them in their importance vis-à-vis their capacity to solving problems.

Traditionally, to a set of problems scientists strive to conceive a corresponding set of solutions. Such a set can be depicted as a symmetry or conformity between problems, on the one hand, and a set of solutions, on the other side. Students are taught that they should identify a research problem and hence after formulating a solution to the problem stated. Metaheuristics, a particularly methodological tool within the sciences of complexity, invite rather to identify a set of problems and, correspondingly, to work out in terms of solutions spaces. The approach then is much more in terms of sets or collections of problems and solutions, instead of just a one-to-one relationship. Cross-disciplinary science devotes its best efforts to seek for a set of solutions to a given set of problems, whether in physics, chemistry, or ecology, or in economics, sociology or politics, for instance.

Briefly stated, to a given problem a set of solutions are proposed that are symmetrical or in conformity with the nature of the problem identified.

Such is the standard approach either from a methodological or from an epistemological point of view. Nothing strange appears in such a comprehension, and spontaneously nearly every scientist would agree with it. Now, the conformity mentioned corresponds exactly, I would like to highlight this, to the scheme of systems science. Given systemic problems systemic solutions are to be provided.

Now, the tragedy of the world consists in that many times scientists displace problems and forget them eventually. That happens most of times because of the conformity between problems and solutions, which in practice means not tackling and solving problems most probably because the solutions envisaged are not sufficient or convenient or economical to overcome the hurdles, for instance.

Indeed, without any reductionism, systems science, very much like cybernetics, can be condensed in one word, namely *control*. A rapid look at the founding works by N. Wiener, L. von Bertalanffy, H. von Foerster, S. Beer, W. R. Ashby, H. Maturana, G. Bateson, G. Midgley, among several others, allows to see how control is the key concept for systems theory -which precisely sets out conditions for practical or applied fields such as systems management, systems psychology, systems education, systems security studies, for instance. The way in which technically the issue is described is as control theory (CT). “Control theory is concerned with several ways of influencing the evolution of a given system by an external action” (Alabau-Boussouira and Cannarsa 2009:1488). There are two ways in which control is studied and implemented, namely via ordinary differential equations, and through partial differential equations. Hence, parameters, control, stabilization appear thereafter, among others, as central concerns, even though there is also awareness of stochastic dynamics, chaos, and fluctuations.

Unlike systems science, complexity theory, i.e., the sciences of complexity, can be condensed in one single expression, thus: gaining *degrees of freedom*. Control and degrees of freedom are scientifically and philosophically completely different concepts, problems, and explanations. Simply stated, the more degrees of freedom a system exhibits or has, the more complex it is. Complexity theory is about introducing or increasing as many degrees of freedom as possible into a system.

As it can be easily seen, the scopes, endeavours, and philosophy of systems science and of the sciences of complexity are entirely different. There is an asymmetry or disproportion between them. Such asymmetry becomes more evident when precisely coping with systemic global problems. It is my contention that any problem of any kind, level or context cannot be tackled and solved with concepts, tools, rods, and approaches at the same level. Quite on the contrary, any given problem can only be effectively solved with a science or discipline of a higher calibre than the ones that constitute the problem. Good science is about developing solutions of a higher, or deeper or asymmetric character than the characteristics and properties that allow a problem to be identify. Otherwise, it should have to be stressed, no problem is truly solved. Science’s drama, very much as humanity’s tragedy, consists in the fact that no real solutions are provided when most needed; at best, solutions are just displaced. A real solution is, to be sure, a solution that stands higher –or deeper, as one wishes, to the level, coverture, dimension, or heaviness of the very problem.

In contrast with the scheme presented above about a symmetry or conformity between problem and solution(s), this essay suggests that an asymmetry of disproportionality between the problem and the set of solutions is not only possible, but necessary.

This understanding of a disproportionality between the nature of the problem and the character of the sets of solutions depicts the fact that to truly solve any problem we need a set of solutions that are perfectly different to the range, standards, history, framework, and mindset that allow identifying the problem and that define it. No problem can be solved at all by any means if there is a conformity or symmetry between the problem tackled and the solution that is searched. The researcher must be capable of figuring out solutions that do not have any logical, epistemological, or methodological correspondence, one-to-one, with the problems the researcher is concerned with. Such disproportionality points out to the challenges capacities, the risk-taken, the creativity and ingenuity of the researchers.

The systemic character of the world

Systems science in general shows how everything is related to everything else, a catchy expression very much used in the literature. Consequently, the call for a dialogue and interaction among different sciences and disciplines arises as a sort of methodological approach. According to the standard story, the systemic character of the world is the outcome of globalization –or *mondialisation* or also *internationalisierung*, three different names for one and the same process of integration, standardization, and normalization fostered by an intricate web of dynamics, such as transportation, information technologies, financial and economic processes of integration and co-dependency, along with cultural processes, at large. The bibliography about the emergence and normalization of globalization is abundant.

As a result, to a systemic world a systemic approach and understanding was developed. It was originally called systems thinking, but it has recently come to be labelled as systems science.

However, the truth is not that everything is related with everything. If that was the case, then nothing would be truly relevant. Assessing that everything is related to everything else is a wishful thinking. The science of complex networks precisely points out to how some things are very much and closely related to others, whilst several others are much less related to everything else. In the technical language of complexity, it is exactly the study of small-world networks, random networks, and free-scale networks. In sociological terms, for instance, M. Granovetter already highlighted in 1973 the strength of weak ties, which allows for relating "micro-level interactions to macro-level patterns in any convincing way" (Granovetter 1973:1360). Weak ties become relevant to understand crucial global phenomena and their fluctuations and turbulence. Simply stated, the weak ties are those that remain in the external surface of a network which precisely allow for networking. In contrast, those nodes that are internal have nearly no relation with other cultures, societies, networks. Granovetter's studies have been largely extended and confirmed in sociology, economics, anthropology, management, and politics. Thus, weak ties allow for making possible hubs and clusters. Granovetter's study simply means that the weak ties refer to those nodes that can link other structures and dynamics because they have rather weak internal links with their own natural network.

Things are connected, indeed. But not everything is connected to everything else. Systems science is both the outcome and a nutrient for such a belief. Technically it is called holism. In this take, the world is believed to be connected in a manifold of ways, contexts, nodes, scales, and dimensions.

Sometimes, such interplay and intertwining have been named, indeed, as holism –a word of preference for systems thinking. Holism has been traditionally taken as defining the diagnostics or understandings of the current state-of-affairs, and very frequently is thought as pertaining to the sets of solutions, too. However, there is a big asymmetry between the diagnostics and the problems to be solved, as it happens. A few technical tools and semantics are provided when tackling solutions of systemic problems, such as "multilevel approach", "multivariable analysis", "multicausal explanation". Those denominations notwithstanding, the truth is that it is language that supersedes facts. Language games would say Wittgenstein –for the lack of real solutions. Despite wide

"epistemological engineering", the truth is that problems around the world, both at the local and at the global level, have been increasing, becoming increasingly intertwined with one another, and the plurality of diagnostics help very little if at all in solving problems.
As a selection of examples of such a situation, among the diagnostics and systems analysis and solutions around the globe several sources can be mentioned: the annual reports of the Club of Rome, the Atlas of Justice Environment, Global Health and One Health, the more than five hundred most prestigious Think Tanks around the world focused on a variety of contexts, the continuous reports by the World Bank and the IMF, the meetings and studies gathered around the World Economic Forum at Davos, the numerous studies by the Rand Corporation, the limitless publications, papers, seminars, conferences… The list is varied and unaccountable. Problems emerge, attack people and societies, life becomes harder. Ethnography, phenomenology, and participatory action research (PAR) are some of the most salient methodologies available that bring to the fore the difficulty about systemic problems and the search for solutions. Day after day new methodologies is suggested and re-invented, such as agent-based modelling (ABM), big-data analytics, simulations of all types, mathematical and numerical analysis, and many others that pretend to tackle and solve systemic problems. At the end of the day nothing significant is truly achieved, for problems and hurdles, challenges and obstacles continue to grow and mingle with one another.

Claiming that our world has become systemic is nowadays a trivial assessment. All levels, contexts, layers and dynamics, agents and consequences are adamantly and increasingly intertwined, even though in different degrees, indeed. Information systems allow to stress the very connected world we are currently living in. Information technologies foster transportation means, financial operations, security issues and many more to very sophisticated levels. Risk studies, numerous observatories, constant surveillance are some of the most salient characteristics of the speedy rhythms the world has been acquiring in recent decades and years.

Being as might be, systems thinking and, moreover, systems science has become a cultural asset of a current educated person, to say the least. Plainly said, it is normal science and education –in the Kuhnian sense of the word. It is the assertion that one cannot divide one aspect of reality from others, one context from others, and that everything is connected. It is exactly in such a tenure that a general theory of systems was once developed, meaning a general theory about how precisely the world and the universe, society, and the economy, for instance, should be regarded as intertwined. Of course, the very idea of connectedness finds its best roots in quantum physics, particularly after the interpretations of Young's experiment in 1802. From then on, the world was conceived as entangled –an expression that was originally coined by E. Schrödinger in 1932 (*Verschränkung*).

System science belongs to a family made up also by cybernetics –including second order and third order cybernetics, and complex thinking in the sense of E. Morin's thinking. In the philosophy of science, such endeavours correspond exactly to coherentism as it was originally conceived by F. H. Bradley and developed by N. Rescher. It is, namely the idea that reality is a sort of puzzle where every single piece must match with all others making up a coherent whole. Coherentism is closely related to epistemological justification bringing up a rationale where the whole is more than the sum of its parts. A large bibliography exists on this subject.

In any case, a systemic understanding of the world stands over against any analytical approach that divides planes, scales, contexts, dimensions, dynamics, and stances. Systems science emerges as the opposite of the analytical tradition that consists in dividing and splitting reality and explaining any given system in terms of the elements that compound it. Meaningfully, Euclide's geometry, at the dawn of Western science and philosophy was entitled as: *The Elements*.

The story, developments, foundations and arrays of and about systems thinking, i.e., systems science have been splendidly summarized in Midgley (Systems Thinking), a synthesis that, nonetheless, does not allow for grain-coarsening about exactly tackling and solving problems. Just a general philosophy, a clear-cut semantics, and some methodologies. Problem-solving, though, remains as a by-side issue.

In any case, it is generally assumed that systemic problems can be tackled and solved with systemic tools, rods, approaches, and methodologies. Systems psychology, systems management, and systems security studies provide good examples about it. However, what is always taken for granted is that psychology, management, and surveillance and securitization always act under controlled systems and at local level. Global problems, though, cannot be regarded locally – even though there is traditionally the call for: "think globally and act locally", which is just a mere fancy utterance. If global problems were correctly identified and tackled, well the world would not be in such a need, and suffering and grief would not be as ubiquitous as they are. Largely, systemic problems are being deflected, to say the least –if not avoided or displaced or postponed.

The need for a complex approach

It is precisely due to the systemic character of the ongoing crises that complexity theory becomes useful, if not epistemologically, i.e., theoretically, logically, and methodologically compulsory. As it is well known, a complex system is characterized by the fact that small changes can bring about large and unpredictable effects that can only be observed at the macro scale. In sharp contrast with systems science's take, a coherentist endeavour almost never helps solve problems. This is why the sciences of complexity dispose of a wide array of tools and methodologies such as agent-based modelling (ABM), computational simulations, non-classical logics, the computational complexity theory including the P versus NP problems, and metaheuristics, among others –not to also mention knots theory and wicked-problems (Maldonado. Teoría de los problemas complejos).

Generally said, the sciences of complexity are about degrees of freedom and thinking and working on the exploration of possibilities –technically named as phase space or also Hilbert spaces. It should always be highlighted thus: working on complex non-linear dynamics is about thinking and doing research on *possibilities* and not just probabilities. The main thesis of this paper argues that thinking about complexity, i.e., working on increasingly complex systems consists in introducing into the world what the world does not contain, or also in increasing in the world what is merely incipient and low, namely *possibilities*. Briefly said, scientists, researchers and scholars should be able to think, conceive, imagine of possibilities of systemic problems, that is figuring out the possible and the impossible –not just work on what is known, but also and mainly on what is not known, and what we do not know that we don't know.

Science consists in the ability to face reality –whatever that is, recognizing what happens, what is at hand, what is out there in front of all of us, and the like. A man or woman of science is the one who can face and recognizing the real. Philosophy consists in changing our attitude vis-à-vis reality –from Plato to Husserl, from St. Agustin to Nietzsche, for instance. The arts, furthermore, do not invite us to face reality but, instead, they create brand new dimensions, realities, and experiences. In this context, the sciences of complexity can be viewed as a synthesis between science, philosophy, and the arts. A few authors and texts point in this direction, such as S. Carroll, S. Kauffman, C. Galfard, Th. Nail, M. Sheldrake, among others.

Complexity theory's specificity consists rather than facing reality in creating, for instance, simulating, intuiting, imagining, working out in and with the possible and even the impossible. This characteristic of the sciences of complexity allows understanding the necessary asymmetry between problem(s) and solutions.

It is an epistemological imperative that a problem is to be solved with solutions that stand out in a higher or deeper level than the problem. The conditions:

a) in which a given problem arises, and
b) that determine the problem at stake

must be radically changed if the problem is to truly be solved. Otherwise, nothing will be really changed in the world; instead, one problem will be cumulating with another and other until an avalanche is produced. Some names for such avalanche in the framework of the social and human sciences are disasters, crises, catastrophes, epidemics, pandemics, wars and armed conflicts, and many others.

Complex systems are, by definition, unpredictable. Literally, *rare events*. Complexity science is about exceptions, randomness, power laws, rather than about tendencies, trends, general goals, prospective, for instance. A strong sense of betting, challenging, imagining, striving for coping even with the impossible are some of the most salient features of good science and spearhead research. This paper will never claim that complexity theory is a sort of panacea, and yet, spearhead science crosses transversally through complexity science, to say the least. Such, nonetheless, is to-date still alternative science –a sociological pedagogical and political issue that must be studied on its own, apart.

Systems science lack a logic of its own, so to speak. *Impliciter*, the logic of systems science is classical formal logic; there is no such a thing as a "systemic logic". In contrast, the sciences of complexity have a wide range of non-classical logics which allow to think in terms of the importance of time, fuzziness, many-values, the epistemology the cognitive agent, quantum dynamics, vagueness, modality, and multi-modality, for instance. In the framework of complexity theory logics is not an "organon"; a plurality of logics corresponds to a plurality of words, logically speaking. Moreover, the semantics of non-classical logics is exactly the semantic of possible worlds, not just the world in general (*überhaupt*).

As for the systemic method or methodology it roughly consists in linking one piece with another, matching one layer with another to reach the whole puzzle that depicts a "complex" relation. In the jargon, systems thinkers like to repeat then, the whole is more than the sum of its parts. What could be called as a systemic methodology is basically uniting, linking and relating all the pieces of a whole so that the whole is explained holistically.

In contrast, the sciences of complexity exhibit a wide variety of methods and methodologies each bearing a significance according to the subject or problem explained. Complexity science has a multiplicity of methods or stated differently, it is characterized by a methodological anarchism in the sense of P. Feyerabend.

As it can be easily seen, weighing different epistemological apparatuses makes all sense, theoretically and from a practical standpoint.

Conclusions: epistemology of complex problems

To the best of my knowledge, contrasting systems science and complexity science has never been done, so far. Weighing different epistemological apparatuses is needed when understanding and solving problems, i.e., crises. It is always the world what is at stake, not just the models, ideas, sciences, and philosophical ideas. Not any method, not any theory, not any approach is valid and certainly not a priori. The need to weigh different epistemological apparatuses arises from the imperative demand to truly solve problems, not to discard them or postpone them. Critical problems are to be tackled and solved, for what is really at stake is life –not just a theoretical stance.

Against all odds, good research is much more, and most probably also very different, to the sheer discussions about methods and methodologies. It is about rightly identifying problems and solving them, period. It is the problem which determines the method. In other words, any method and/or methodology depends upon the nature of the problem. Now, not every problem is complex. Moreover, most problems are not complex in the largest but strongest sense of the word. A problem can and must be called as complex when the tools, concepts, and methods *available* are not sufficient to grasp them, understand them, and solve them. Therefore, brand new concepts, brand new approaches, yes: brand new rods and disciplines must be developed that can cope with the problem identified and solve it. Th. Kuhn, on the one hand, and A. Koyré, G. Bachelard and G. Canguilhem, on the other side called for the emergence of scientific revolutions. A scientific revolution is the outcome of the presence of anomalies, and henceforth the need to think differently, namely, to see the unseen, the speak the unspeakable, to do the impossible.

The social and human sciences at large bear a strong responsibility vis-à-vis understanding what is going on around in the world and trying to make life possible amid crises, disasters, suffering and lack-of-hope. Such is at the same time a moral and an epistemological responsibility. Apparently, we are currently facing the collapse of a highly integrated and global society. Name it as you wish. To be sure, a systemic collapse does not entail determinism or fatalism. Quite on the contrary, good science –very much as good philosophy and arts, truly consist in eyeing or imagining possibilities, horizons. Now, possibilities are the outcome of the capacity to figure out solutions that stand higher –or deeper, if you wish, to the problems identified. A heavy or strong disproportionality between problems and solutions is not only desirable but compulsory.

After all, doing good science and good research is about making life possible and always as much possible as imaginable.

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