Review: Complexity

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By Morris M. Waldrop - Instar Books, pp. 621

The year is 1987. In one of the book's episodes, an American economist comes into contact with the world of complex systems simulation and thinks of applying its rules to social processes. He would like to create a computer model that can evolve autonomously, without the need for outside intervention. The individuals who make up his starting economy - an elementary agrarian economy - have intelligent behaviour and are capable of learning. Their intelligence, however, derives not from particular features of each individual's brain - they have no brains - but from the interaction that makes them an organic whole. The elements of the system are absolutely simple, receiving and exchanging information according to a few pre-determined rules, but their relationships result in a very complex system. "*With this very vague idea,"* says the economist, *"one morning we would get out of bed exclaiming: hey, look at those guys! Two or three weeks ago they only knew how to barter goods in kind, and now they are already forming corporations. The next day one would go and take another look and, toh, they discovered central banks. And after a few more days you would come back with all your colleagues: look, look! They formed the unions! What else will they come up with now? Or half of them had become communists."*

It's not a bad result of a society in a test tube. Designed to simulate by heuristic methods what analytical methods had never been able to do, that is, formalize the tendencies of capitalism, that it produces communists. Half the population, too much grace.

Forecasting trends in the economy is the black beast of economists. No one predicted a stock market crash in 1929, and the mountains of subsequent studies underscore the blindness of the men of the time who did not see the evidence. It is said that there was a lack of forecasting and control techniques. Not true, there were but they did not work: mathematical modeling of the economy had already reached a very high apex by the end of the century. For that matter, not even in 1987, when by then there were very sophisticated forecasting models, including computer models, was the 500-point collapse on Wall Street predicted in a single day, and the meltdown was avoided because the automatic mechanisms for buying and selling securities could have their plug pulled. The collapse of the Soviet Union, and the whole system connected with it, had also occurred without anyone being able to predict a catastrophe of such

historic proportions. Only a few communist fools (us, for example) had been waiting for the great confession of real socialism for years.

Why are complex systems models so inadequate to do what they were designed to do? Or rather, why do complex systems elude every kind of modelling devised so far? Yet science has brilliantly solved the handling of complicated systems: classical mechanics has excellent solutions even for extreme situations, and statistical mathematics has reached high levels of sophistication.

The book is like a novel. It talks about the complex system of which humans are a part, and it deals with the methods they try to apply to know it. At the bottom it is the story of nature knowing itself and, in order to do so, suggesting to the men who are part of it the way to the solution. It is not certain that along that road capitalist man will reach the goal, but certainly the system is beginning to need to make a qualitative leap, to overcome the anarchy that characterizes this long "human prehistory." Everyone who chews a little Marxist doctrine immediately senses that there is something very, very big underneath this problem.

For us, "complex system" is another way of saying "organic system," i.e., vital, i.e., capable of self-organization and thus of producing qualitative leaps from existing material, without creations due to deities, thought-forms, victories of reason or strong, genius leaders. The etymology of the terms also underscores this fact: complicated means "made of many things connected," complex means "made of many things interacting." Interaction is a specific feature of systems that escape traditional formalization: social systems are highly complex because humans interact, and the capitalist social system is the most complex of all because in it, in addition to humans and things, the reflections of their social relations, that is, value determinations, interact, abstract, intangible entities that are difficult to represent analytically. The complexity of capitalism, its capacity for self-organization, is capable of giving rise to new conformations and structures from its genetic program: cancerous metastases that will kill it and, at the same time, embryos of a new form of life.

It is no coincidence that in the book we intertwine, as in action novels in which parallel stories are made to converge toward the final dissolution, the vicissitudes of separate researches, on economics, physics, evolution, computer science; all of which have a common trait: the impossibility of reaching some conclusion by continuing to exist, precisely, as separate sciences. And here again, knowing how Marx was keen to demonstrate the end of philosophy and the specialized sciences as the epoch of unified knowledge of the world clicked, we communists take our satisfaction.

But there is much more in this book, as indeed we verify with other books that the bourgeoisie is producing, just know how to read: every complicated system is but a sum of parts, as a pile of sand is made up of grains. What is complicated about a pile of sand? There can be a lot: for example, it is complicated to make calculations about the situation of instability that occurs when in the pile, dry and formed into a cone by falling grains, you add the grain that causes the walls of the cone to collapse.

Every living system is undoubtedly complex, but not all of them have the same degree of complexity: for example, the billions of tiny polyps that form coral reefs with their excretions are certainly not assimilated to grains of sand, but, even being part of a delicate ecological system, they still remain distinct individuals. In contrast, the differentiated cells that make up a living organism belong to a system of high complexity, in that they each participate in the whole, and with the whole, they exchange energy, nourishment and information.

These could be examples presented by the book in question, which not coincidentally recounts research on the similarities of certain models with the processes of life; instead they are taken from a text of the Communist Left, Economic and Social Structure of Today's Russia, where the concept of organicity is explained in relation to the complex system of capitalist society and that of the revolutionary party that will result. The democratic party is made of undifferentiated individuals, placed in a pyramidal pile; the Organic Party is made of differentiated men-cells, participants in a whole governed by an invariant genetic program. The militants of the party of the coming revolution are not a mass of grains but a network of relationships governed by laws.

The concept of complexity borders on that of chaos: in a world of relationships, a small variation at a nodal point can cause effects that are not small at all. *"All things and individuals in the world,"* the book says, *"are part of a vast nonlinear network of incentives, constraints and connections. The slightest change in one part of it produces upheavals in the others. We cannot avoid disturbing the Universe. The whole is almost always equal to much more than the sum of its parts. The mathematical expression of this property [when it is possible to arrive at it] is a nonlinear equation."* The evolution of systems and of life itself is a nonlinear process. In a complex system such as the primordial Earth or today's society, even Darwin's claims, which were grandiose for the time when they demolished the static conception of the living world, become relative: unless we find an objective definition of the concept of "adaptation," the qualitative leaps brought about by evolution, i.e., biological or social revolutions, we will never understand the underlying law of change, because "survival of the fittest" becomes a tautology, like saying survival of the survivor, and does not explain why this can happen. But where does the information come from that acts on species and societies over time then fixing itself in the genetic or revolutionary program? Nonlinear systems are difficult to deal with, but that

does not make them indeterministic: the law of revolutions exists, can be discovered, and never gives rise to random results.

Scientists try to avoid nonlinear equations since they involve difficulty - and often impossibility - of solution. Computers have partly solved this problem in that they make possible search models whose results can then be formalized analytically, but some models are so sensitive to initial conditions that they easily result in chaotic situations. Again, while some time ago there were still those who believed in drawing indeterministic, possibilistic conclusions, modern theory has come to the conclusion that structures detectable even in chaotic situations prove the existence - always - of deterministic processes. After all, order is equilibrium, and nothing new can emerge from order: only from chaos is it possible for a new level of order to emerge. Capitalism is highly unstable, a generator of economic and social chaos, which is why it is also the highest generator of revolutionary potential in history. It is not for nothing that Marx, in The Manifesto as well as in Capital, makes an apologia for it for many pages: communism is not a utopia, it is reality on the march, and it is an extremely complex reality, about which one cannot speak in earshot using the opportunist digest.

Marx's work has been deformed, betrayed, humiliated by vulgarizations taken at face value by bourgeois ideology. The same thing happens to science when it touches the borderland with future knowledge. No matter, we read in 'Complexity', every complex system takes revenge and produces appropriate emergent structures. We translate for the social system: adequate theory and practice. If the system is truly complex, the author continues, interpreting the scientists he interviews, the same configurations are never repeated; therefore, the language appropriate for old configurations may be obsolete and humans no longer understand each other. However, invariant themes remain, and it is also revolutionary politics to use the language appropriate to each revolution. *"In history, we can speak of revolutions even though one revolution may be entirely different from the other. So we resort to metaphors. Political activity largely consists of finding the appropriate metaphor. And bad politics involves the use of bad metaphors. [...] There are people who are attuned to this kind of thing. They are those who like process and configurations, as opposed to those who are more comfortable with stasis and order."* A new metaphor for complexity scientists can be "edge of chaos or anything else": the important thing is to establish that, in the context of the work in which it arose, the definition has a meaning that the entire scientific community shares and uses from that point on as a natural thing because it is produced by reality itself and not by someone's imagination.

Complexity is like a novel, we said. Written by a science popularizer and scientists who certainly are not thinking about communism and revolution, looking for solutions they will not find in this society. But read with attentive

eyes it is a novel about a stretch of the long road that man is taking to free himself once and for all from ancient mysticism and come to a materialistic and dialectical understanding of the world, not out of intellectual philosophical whim, but out of necessity, to change it.