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NICHOLAS GEORGESCU ROEGEN:THE GREAT DISSENT

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What is a rebel? A man who says no,but whose refusal does not imply a renunciation. He is also a man who says yes,from the moment he makes his first gesture of rebellion. This is how Albert Camus defined him,and I found the definition perfectly fit for Nicholas Georgescu Roegen.

Born in Romania in 1906,he obtained his first degree in mathematics from the University of Bucharest in 1926,and went on to take a doctorate in statistics from the University of Paris in 1930. Here he brings the world into the classroom with him.He wants to communicate with this world:

> "For my dissertation at Sorbonne I followed the line of the smallest effort for a mathematician and thought up a mathematical method for finding out the hidden cyclical components of a statistical time series. I had only to deck it out with an application.Since economic time series were then,still are,enjoying great consideration,it would have been to my professional advantage to apply my method to such a series.My superficial knowledge of economics nothwithstanding,I felt that economic phenomena do not behave so nicely as to be describable by a mathematical network" [1]

The current demand for relevance demonstrates clealy his later concern for understanding contemporary issues and for responding to them. The rethoric of no was his response:

> "Under Schumpeter's guidance I plunged into the writings of Vilfredo Pareto...My first paper on mathematical economics was on one of his missteps"

Bored by a daily pablum of advertisements,the student begins to hunger for real argument,for real conviction. His work concentrates on a dominant characteristic of our contemporary dialogue - that of dissent. Each paper,with its own distinctive voice,is saying no in one way or another to some blind assumptions.

Taken together,they deal with many of the unresolved controversies of his time. His career shows a steady expansion of outlook and interests from an early phase of highly technical mathematical economics,largely in utility theory and input-output analysis,to a later phase of growth modelling and the ambitious attempt to formulate the principles of bioeconomics,a new style of economic thinking to replace more or less the whole of present day economics with its mechanical mode of reasoning.

The earlier phase is well represented by such famous articles as "The Pure Theory of Consumer Behaviour" (Quarterly Journal of Economics,August 1936),as well as his practical activity.Looking forward to a busy career in Romania he remembers how

> "at that time all countries with which Romania traditionally traded were fully preocupied with getting more guns,not more butter...In one delegation for the negotiation with the British in late 1937 I was inlcuded not for being an economist but for

> being one of the very few (then)English speaking Romanians. On that Occasion I learned that things were worse than I had feared. I froze as I heard Sir Leith-Ross,the BRitish Chairman,explaining that His Majesty's Government considered Romania to be in Germany's sphere of influence....Yalta and Postdam (later) shattered my hopes to see the world reorganized the principles for which Great Britain and the United States had entered the war. I began thinking of fleeing Romania before I would be thrown into a jail."

He arrived at Harvard in early July 1948 to become a disenchanted neoclassical economist

The earlier phase ends with his contributions to Activity Analysis of Production and Allocation (Yale University Press,1951).The later phase begins with Analytical Economics:Issues and Problems (Harvard University Press,1966) but is more clearly set out in The Entropy Law and the Economic Process (Harvard University Press, 1971) and Energy and Economic Myths:Institutional and Analytical Economic Essays (Pergamon Press,1976). Somewhere in the middle are innumerable articles on special problems,such as production theory,the nature of expectations,the anatomy of agrarian economies, and the Marxist prediction of capitalist breakdown.

Almost every important theoretical problem or relevant issue bears the mark of his pen. In production theory,where he was one of the pioneers of the theory of linear systems,his contributions extent from the two most important theorems in the input-output

analysis to a radical reformulation of the concept of production function. No American Economist has more successfully combined in his publications the fields of economics,mathematics and statistics.

Again the roots seem to be there in Romania:

"I entered into a wonderful friendship with Andrew Edson, the Secretary of the United States Legation in Bucharest,a man of multiple talents and an economics PhD candidate at Harvard. One day Andy said softly:Romania is economically undeveloped because your institutions are silly.You pay a salary to the legion of doormen who just sit at the door of every high functionary,public or private.They produce nothing to deserve their pay. Andy,a strong believer in the neoclassical dogma,thus opened my eyes to the violation in my own backyard of the sacrosant principle of neo-classical economics:the marginal pricing. That icy shower on my religious confidence in mathematical economics, started me worrying and thinking and thinking. The solution when it hit me was that marginal pricing does not maximize the national product proper - an idea that undoubtedly strike a standard economist as a ridiculuous product of some economic ignoramus. Yet the fact is that only in the lands of plenty does that principle maximize a complex of product proper and chosen leisure. Indeed their peeple can afford to trade-off real income for leisure time,as the neoclassical theorem states if corectly interpreted.In the lands of scarcity,however,people must work as much as they can,to the point of zero marginal productivity of labor"

Half the sorrows of the world,I suppose,are caused by making false assumptions. If the truth were only easier to ascertain the remedy for them would consist simply of ascertaining it and accepting it. This business,alas,is usually impossible,but fortunately not always:now and then,by some research process,half rational and half instinctive,the truth gets itself found out and an ancient false assumtion goes overboard.

The essence of Georgescu-Roegen's bioeconomics is the notion that production,involving as it does the transformation of what is for all practical purposes a constant stock of matter and energy,must conform to the same Law of Entropy that governs all closed systems: entropy or unavaiable matter and energy tends constantly to increase,while available matter ane energy tends constantly to decrease. Economic growth only appears superficially to increase output per unit of inputs; in fact,it does so by using up the finite stock of the world's matter and energy. Thus, industrial societies relying on fossil fuels and other mineral inputs are necessarily subject to entropic decay through extraction on the one hand and pollution on the other. It is in this sense that production even with technical progress is subject to historically diminishing returns. The old idea of a stationary state as the terminus of economic growth, a situation in which the economic system replaces itself preciselt from time period to time period and does so forever,is a simply impossibility.

> "Economists,naturally,have made a defensive circle around the dogma that market knows best,that prices will take care of any economic turnabout. I have strongly dissented from this economic phantasy.It has been apparently completely

ignored that we could not accpte the principle that the polluting driver should pay: instead,we have enforced the use of the catalytic converter by law"

That reason and logic are the chief concerns of a discursive writer is apparent from a glance. Nicholas Georgescu Roegen always emphasizes orderly progression of evidence and ideas in support of reasonable judgements. Therefore,he makes special demands upon his reader.He trusts him to think,to change his opinion despite any personal leanings he may already have,to follow an argument and evaluate it.

On the other hand his writing is a way of listening to himself, a way of exploring his own opinions and feelings.Thus the reader becomes an extension of the writer,a kind of alter ego listening in to what is being tought.His tone reveals a feeling of intimacy with his subject,a quiet,familiar concern.His attitude remains calm,he does not shout or demand,accuse or command.Sometimes he does not necessarily try to arrange his argument in a formally way.Then,his main interest is in sharing,rather than presenting his argument.

> "My strongest epistemological uneasiness concerns the use of differential equations to show how growth can be achieved without any ado.A common idea is to take any differential system that represents some growing process,a definite trajectory of which is determined if we fix the values of two parameters.It has been implicitely and even explicitely assumedmany times over that by assigning to these parameters any desired value, a poorly going economy will at once begin to grow as described by the chosen differential system.

> Of course , this is the acme of self-description which make me think of Abraham Lincoln's well-known protest - if you just call a slave a free man you have not freed him. Economic growth politics needs much more constitutive considerations than a simple motion on paper-and-pencil".

The real meaning is a strong dissent from arithmomorphism. Nicholas Georgescu Roegen is aware of the existence of dialectical concepts which overlap with their opposites. That is A and non-A may be both true.

> "Certainly,a baby,now young,will be old when he will be ninety; but no one can say when he will just become old".

This is how I got interested . Can precision be a vice and vagueness a virtue? Yes says Nicholas Georgescu Roegen. Yes,I said together with a new breed of logicians whose way of thinking was anything but Aristotelian. I met him in the late 1970s and I tried to explain my position.

If a bald-headed man sprouts a single hair,is he still bald? Most people would say that someone with only one hair on his head was bald,although the man himself might beg to differ.But what if he grew another hair,and another,and another,until he had accumulated thousands of hairs? At what point would the addition of a single hair transform a bald man into one no longer bald. Or take the case of a rock pile. If enough stones are added,it will eventually become a mountain.But how many stones would it take? Brain teasers like these expose the glaring imprecision of language in drawing distinctions. Indeed,we seem to relish this linguistic looseness and even compund it

by talking of a partly bald man or a large pile of rocks.But when we turn to computers for the solution of problems,such fuzziness of expression invites trouble. With its built-in obsession for exactness,the electronic brain,unlike the human one,needs to know precisely how few hairs make a man bald and how many rocks add up to a mountain. Nowhere has the need for cold,unerring exactitude been more apparent than in the growing field of artificial intelligence. In this area computers were being asked to solve real-life,imprecise formulated problems. Once such problems were thought to be totally beyond the range of machines because they involved just the sort of casualness of language characteristic of human communication.

Some answers,I said,were coming from a new branch of mathematics with the paradoxical name of fuzzy systems. Until recently this was the intellectual plaything of a handful of college professors. Now it was being used to enable computers to cope with human imprecision, to deal with such vague terms as "beautiful" and "very",mimicing that highest of human qualities:common sense.

He was listening to me with visible interest,and I continued to speak about our attempts to establish any possible connection between fuzzy sets and the theory of elem tary topoi particlarly attractive because it unites two previously distinct branches of mathematical thought,algebraic geometry and logic,thus bringing geometrical intuition into the tool kit of the logician. If it were known that the fuzzy world of dialectical concepts were a topos, then we would not only know that the crisp quantifiers lived in that world,but would have an explicit,essentially algebraic construction of them.

Fuzzy systems provide just the principles needed to deal with large scale models of the vagueness of the real world,as we perceive it,I continued.

I ended with a confession.So far,I said,my fellow scientists have treated my philosophy with complete silence.

Then I remembered Camus who said that rebellion does not arise only,among the oppresed,but it can also be caused by the mere spectacle of oppresion of which someone else is the victim. In such cases there is a feeling of identification with another individual. And it must be pointed out that this is not a question of psychological identification - a mere subterfuge by which the individual imagines that it is he himself who has been offended. On the contrary,it can often happen that we cannot bear to see offenses done to others which we ourselves have accepted without rebelling.

A thoroughly supple knowledge of the ways in which the world tried to take him,and a confidence that his own ways were more just and liberating,was apparent here and everywhere in the conversation.

I thought about him afterward,and I started to review his books. What was the cause of his rebellion? Why the market system by itself results in resources being consumed in higher amounts by the earlier generations,that is faster than they should be,thus confirming the dictatorship of the present over the future? Why the market mechanism cannot protect mankind from ecological crises in that future,let alone allocate resources optimally among generations,even if we try to set prices right? Why the same economic theory is not generally valid for all societies?

The last question was fascinating . In Georgescu Roegen's opinion, tradition is a code of transmitted values or institutions,according to which every man acts inside the community he lives in.This is the cultural matrix. Man does not have innate social instincts as insects have. So he is obliged to shape his own code for guiding his

complex activities. This is tradition. It parallels the biological code. The initial relation between town and villages is at the origin of the peasant's deep distrust of every idea the town tries to sell him.

> " Where the villages happened to be exploited for long periods by the state to the limit of mercilessness,the peasant first tried to appear poor to the tax collectors.Continuous exploitation made him really poor. Ultimately he discovered that working just enough to stay poor was the best strategy for making the most of his life in the struggle with his exploiters. The cumulative inertia of tradition dit the rest"

The standard framework for consumer behavior,production functions, marginal productivity of labor,Walrassian equilibrium,and other neo-clasical concepts cannot fit the conduct within peasant communities. Standard economics is built on the assumption that the world is made up of city men. Immense economic loss as well as great social evils may result from a forced introduction of highly developed technological industries into communities deprived of the corresponding propensities. Very close to my own conclusions coming via an experimental way. What was new was theconfession.

Georgescu Roegen confesses that in the early 1930s,when he returned to Romania from western universities where he had got educated,trained in the most sophisticated methods of mathematical economics,he found to his astonishment that this formidable weaponry helped him in no way in understanding the problems of his native land. The instituted sets of socio-cultural norms were not adapted in this country for the application of the Walrasian principle of profit

maximization,a fact which to other western observers,too,seemed to be a patent proof of organizational inability. He gradually became aware,not without intellectuak discouragement,that those institutions imperfect as they were,were wonderfully adapted to an agrarian economy in which a large part of the population was totally superfluous against the available land and capital.

I am not saying that suddenly my mind came to its senses and fought its way to a more accurate picture of Nicholas Georgescu Roegen. But over time,starting with our first conversation,I did come to see more and more of his thinking,and the more I saw the harder put I was to fit him into conventional categories I had brought with me when I first met him.

Roegen's position is not only unique within economists at the present time,but is probably unprecedented in the whole history of the subject. His publications revolutionalized the scientific study of economy;and now,at the age of 84,he speaks with unrivalled authority on all aspects of knowledge. THis is not to say,of course,that all economists have accepted his theory put forward some fifty years ago.They have not. There are at least as many recognizably different schools of econmics throughout the world as there were before the Roengenist revolution. But bioeconomics is not just one of them. Right or wrong Roengen's theory of arithmomorphism is undoubdetly the most dynamic and influential; and no scientist who wishes to keep abreast of current developments in his subject can afford to ignore Roegen's theoretical pronouncements.

The last time I met him was in Nasville,in 1982,when he invited me at Vanderbilt University for a couple of months.

I was charmed by the free conversational directness of the man.The

fuzzy set theory is arithmomorphic,he said with a quiet even diffident friendliness. He made me at once aware of the thick,compacted strength of his body,even now at 76; it was apparent in his face,actually too alive and spontaneously expressive to be as ruggedly heroic as in his photographs. But there was no mistaking the evidence of the enormous power of his personality.

The impression of massiveness,far exceeding his physical size,was not separable from the public image he created and preserved. He stood talking for a few minutes in the middle of the room,in his cosy home, and I wondered for a moment how he had managed over so long a life never to let his self-portrait be altered despite countless exposures to light less familiar and intimidating. He reminded me of my father with his Spartan simplicity,somehow related with alleged irrationality of the peasant behavior."

He asked me about my research. I said that not all relevant aspects of human systems can be measured and modelled.Models are therefore always limited,hence wrong representations of a system. Succesful rational steering of macrosystems requires the use of models.Therefore steering will lead to unintended and unanticipated developments. He answered that scientific bias in conjunction with political power interests lead to biased models,although this is often not recognized or strenously denied. We concluded that interests groups struggle to acquire and maintain model monopolies in order to push through system developments that favor their own interests,

We began to wonder,hard as it was even to begin to do it,if the dream of arithmetization,corresponding to the present mechanistic faith,formulated by Leonardo da Vinci when he said

that a bird is an instrument working according to mathematical laws,was the same with what Turing said about computers ,

> "My epistemological addiction is the reason why I am against arithmomorphia. I have only words of protest for the typical assertion of a physicist that it is not necessary to explain phenomena before dealing with them mathematically. If one starts only with mathematics,one is likely to be trapped inside it".

A conversation of this sort is not free:its first purpose is to make plain and interesting the opinion of one man by having another ask the right questions.

Was Georgescu=Roegen a rebel? He said no,but his refusal did not imply a renunciation. He was also saying yes,from the moment he made his first gesture of rebellion.

> "I was going against a current. What I have usually done was to make my interlocutors consc us of one of their flat,latent opinions. In my earliest contributions I actually ran with the current which then was to expand the legitimate use of mathematics in economics,a program in which I have never ceased to believe".

There were so many things to understand in those days and I was sad when we talked about something else.

[1] All the quotations are from 'My Life Philosophy",a paper written by Georgescu-Roegen for American Economist (to be published)