Nicholas Georgescu-Roegen

(Costanza, Romania, 1906 – Nashville, Tennessee,1994)

Nicholas Georgescu

Nicolae Georgescu

N(icola)e Geor(gescu)

NeGeor →

negeoR →

Roegen

the exosomatic nature of human evolution

the economy is an entropic process → main interest in the qualitative and irreversible changes in the economic development

Life

- 1906 Constanza
- 1926 University of Bucarest: degree in mathematics
- 1930 Sorbonne (Paris) PhD in Statistics (Borel, Bergson,Whitehead, Pearson)
- 1930-32 London Post-Doc (K Pearson)
- 1932-46 Professor of Statistics - Uni Bucarest
- 1934-36: Harvard economics (Schumpeter, Leontief)
- 1937-1948: Romania
- 1948 - 1950: Harvard
- 1950 -1974 Vanderbilt University (Nashville, Tennessee)

Scientific activity

Consumer theory and linear activity models of the Leontief type.

1965→ Production Theory: flow-fund approach

- *Analytical Economics* (1966) (Flow-Fund)
- «*Some Orientation Issues in Economics*» (1966), epistemology

1971→ Bio-economics

Production: flow-fund

Flows are ‘materials’ qualitatively transformed

into a process. They are elements that enter but do not come out of

the process or elements that come out of the process without having entered.

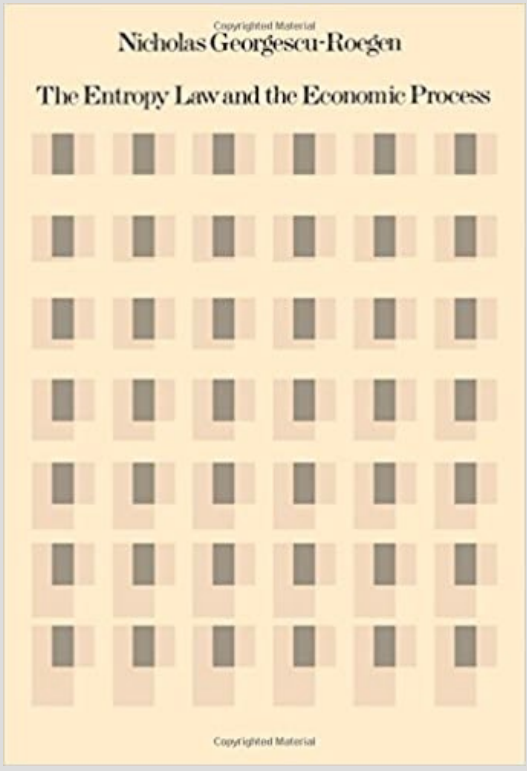
Funds are agents transforming a given set of inflows into a given set of outflows.

They are the elements that enter and leave the process unchanged:

labour, capital and land

IMPLICATIONs → substitution possibilities and strong vs weak sustainability

The Entropy Law and the Economic Process (1971)



The entropy law and the economic problem

«To explain in detail what ENTROPY means is not a simple task …

A measure of the unavailable energy in a thermodynamic system …

cannot satisfy the specialist but would do for general purposes»

Two qualitative states of ENERGY

Available/free

Unavailable/Bound

not available to work

The entropy law

«The chemical energy contained in a piece of coal is free energy because man can transform it into heat or, if he wants, into mechanical work.

When a piece of coal is burned, its chemical energy is neither decreased nor increased (1st law – conservation).

But the initial free energy has become so dissipated in the form of

heat, smoke, and ashes that man can no longer use it.

It has been degraded into bound energy»

The entropy law

«Free energy means energy that displays a differential level»

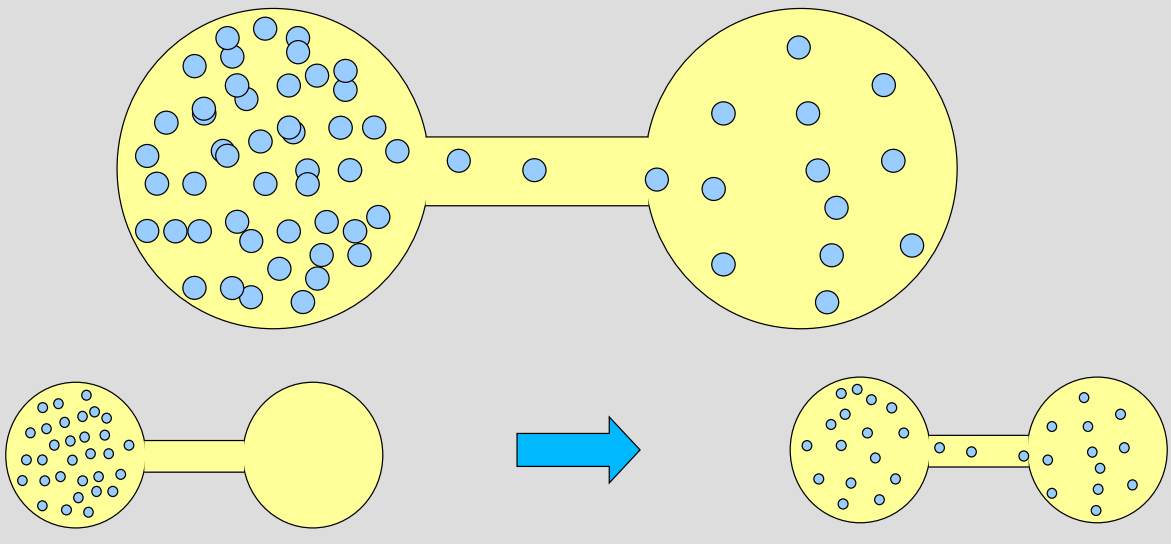
Think to hydro power!

→ ORDER VS DISORDER

Enthropy: measure of disorder

The Entropy law

Two glass spheres with some molecules of gas



From order
(far from thermodynamic equilibrium)

to DISORDER
Thermodynamic equilibrium

The entropy law

«heat moves by itself only from the hotter to the colder body …
once the heat, of a closed system has diffused itself so that the temperature has become uniform throughout the system,
the movement of the heat cannot be reversed without external intervention.
[…] the free heat-energy of a closed system continuously and irrevocably degrades itself into bound energy. […]
[The entropy] law states that the entropy (i. e., the amount of bound energy) of a closed system
continuously increases or that the order of such a system steadily turns into disorder.»

Three types of systems depending on the exchange with the outside
Open Both matter and energy)
Closed (Only energy)
Isolated (neither matter not energy)

Entropy, time arrow and irreversibility

- QUALITATIVE CHANGE because of entropic degradation
- Change in physical, biological economical variables
- Irreversible change, arrow of time

Qualitative change and epistemology

Schumpeter and innovations:
'that kind of change arising from within the system *which so displaces its equilibrium point that the new one cannot be reached from the old one by infinitesimal steps*' (Schumpeter, 1951: 64).

'[add] successively as many mail coaches as you please, you will never get a railway thereby' (ibid.).

QUALITATIVE CHANGE → GEORGESCU
arithomomorphic vs dialectical concepts

Dialectical vs arithmomorphic concepts

qualitative changes due to the emergence of novelty →

reality can be grasped only when arithmomorphic analysis is combined with a dialectical approac

Dialectical reasoning (Hegel) can be as correct as mathematical reasoning, and even more penetrating

Dialectical vs arithmomorphic concepts

- Semantic boundaries are not rigidly and exaclty defined
- "penumbra area" (Bridgman, operationalism)

Example:

Democracy

- Discrete: strictly delimitable and definable concept.
- clearly distinct from each other (semantic univocity).

Examples:

numbers; symbols (n, m); the concept of a triangle or circle.

Computers are an example of a system based on arithmomorphic logic.

Classic logic (e.g. the law of Non-Contradiction) can be used only for
objects that are clearly distinguishable,
with the same properties as those enjoyed by numbers in **arithmetic**.

Mechanistic sciences

- BASED on hypotheses and deductions
- Require arithonmoprhic concepts

G.R:: NOT SUITABLE FOR DISCIPLINES such as

sociology, biology and economics are disciplines (among others)

→ qualitative differences and change characterise a large part of the phenomena which they investigate

Entropy and «What is life»

«every living organism strives only to maintain its own entropy constant.

To the extent to which it achieves this, it does so by sucking low entropy from the environment to compensate for the

increase in entropy to which, like every material structure, the organism is continuously subject.

But the entropy of the entire system -- consisting of the organism and its environment -- must increase»

The economic process

«from a purely physical viewpoint, the economic process only transforms

valuable natural resources (low entropy)

into waste (high entropy)

the true economic output of the economic process is not a material flow of waste,

but an immaterial flux: the enjoyment of life.

Bio-Economics = biology + economics

Georgescu combines elements of
evolutionary biology,
institutional economics
and bio-physical analysis associated with
energy and mineral resources

Exosomatic evolution!

THE PROMETHEAN CONDITION OF VIABLE TECHNOLOGIES

Nicholas Georgescu-Roegen

ABSTRACT

Many species use tools to achieve some useful purpose. Some even make their tools. But only homo sapiens sapiens makes tools to make tools, to make tools . . . For these tools, which are in fact detachable organs, we have come to tap in staggering measures resources from the bowels of the Earth, for we need both energy and matter in a special state to which we refer as "available."

Exosomatic evolution

1) Central role of FOSSIL FUELs and their scarcity

2) Social conflict of the human species is the result of exosomatic evolution

«Unfortunately, social conflict will remain part of the human lot as long as
our mode of existence depends on large-scale exosomatic production and distribution»

3) Inequality among nations and generations

Exosomatic evolution: fossil fuels

Fossil fuels are ‘optimal’
in terms of the amount of matter in bulk required for energy extraction, transformation and transportation
to support the intensive industrial processes of the modern industrial society

Solar energy → weak-intensity energy
cannot easily support current fossil-fuel based manufacturing processes.

Exosomatic evolution: feasible recipes

A **feasible** recipe is
a procedure that uses an available set of necessary factors for achieving a goal.

It must specify the flow and fund elements, and their tempos, required for transformation of the inputs into outputs.

Baking bread, for example, is a feasible recipe,
but controlling a thermonuclear reaction is not a feasible recipe at this moment.

Exosomatic evolution: promethean/viable technology

'viable' WHEN
energy return is sufficiently large to maintain its own operation, *plus* some additional energy left over for other use.

Prometheus I launched the Wood Age by revealing to man the burning of wood as an energy source.

Increasing deforestation required a Prometheus II, who came in the form of the inventors of the coal-fired steam engine.

The increasing scarcity of coal and other fuel reserves leads us now to await hopefully the arrival of Prometheus III

Exosomatic evolution: Social conflict

Georgescu with Lotka:
the fact that **control** over exosomatic resources (accessible energy) is unevenly distributed across nations and individuals has led to
'so much of the social unrest that has accompanied the development of modern industrialism' (Lotka, 1956: 370).

Since the adoption of agriculture the social classes of 'ruler' and 'ruled' are created to socially organize production and distribution.

Exosomatic evolution: intra- inter- generation conflict

CONTROL over accessible energy → the inequality among different exosomatic 'species', for example, the difference between the developed and the underdeveloped countries (Georgescu-Roegen, 1977a).

Intergenerational distribution issue.
«[each] generation can use as many terrestrial resources and produce as much pollution as its own bidding alone decides.
Future generations are not, simply because they cannot be, present on today's market' (1975: 374).

Bioeconomics problems

- Analytical representation of variaty and qualitative change.
- Directionality of time and irreversibility
- The economy as a thermodynamic open PROCESS (analogous to biology; interdependence Human-Nature; only degrowth is possible because of entropy)
- Biological evolution vs human evolution (similarity and differences)
- Ethical solution and minimal bioeconomic program