

.. A Madman, an Economist or a Cyberneticistⁱ
Growth and the second law of thermodynamics
On the Solow-Daly debate

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Abstract:

It has been famously - and satirically, articulated that "Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist" - Kenneth Boulding. Adding a "Cyberneticist" to the list -satirically, this short paper is in support of the post-Keynesian neoclassical (potentially green) economics versus the Degrowth discourse - based on the laws of thermodynamics argument and the technological current and prospective (r)evolution.

The controversy between neoclassical economy and ecological economy has heated up in many ways, and lately by the Solow-Daly debate. Solow, who is a Nobel Prize Laureate has a valuable contribution to the economic post-Keynesian neo-classical model.

Among his views is that scarcity of resources is relative, and that scarce natural resources can always be substituted by other resources that are abundant (or man-made), before we run out of the former. While Daly draws on the second law of thermodynamics to support his 'Degrowth' approach.

Economists who believe in the ability of technology to save humanity are branded 'technological optimists'¹.

I argue here that the second law of thermodynamics has been (persistently) misrepresented by Herman Daly - as Solow also notes, and in spite of Daly's subsequent replies (Solow, 1997; Daly, 1997).

Complementary to understanding the laws of Thermodynamics, there is the basic equation indicating the relationship between matter and energy (and subsequently the position of information) given by Einstein [1905 cited in Umpleby (2007), which is:

$$E=mc^2$$

Energy on earth has no known limits (that is that the planet as a system has become - through the advancement of technology, innovation and accumulation of knowledge, an open system when it comes to energy) in spite of the second law of thermodynamics. As

¹ A cyberneticist (system/ holistic thinker), on the other hand, is not a technological optimist. Technology is a good tool but a fatal master. It has been (scientifically) predicted that technology (specifically artificial intelligent) might be the reason why humans would go extinct.

Einstein's law points out, matter and energy are naturally irreversible, thus finitude (from a human perspective) would depend on the efficiency in handling such flow of energy and matter (through editing system information) in a manner that simulate and interact synergistically with natural laws and cycles.

This is definitely challenging. But that's all what it is: 'challenging'! Not unattainable or impossible - in principle. The challenge does not even arise from its technical dimension, but surprisingly from the sociological aspects related to building consensus/synergy on the equitable and efficient allocation of resources - currently problematic. It's more of a governance problem representing what economists regard as a "perfect moral storm" (Gardiner, 2006).

The mobilisation of energy/matter into our life organisation may thus increase exponentially by efficient waste management and advancement of technology to preserve matter while increasing energy flow (see Garner, 1995; Global agenda Council on Decarbonising Energy, 2015).

Not only the photosynthetic energy coming from the sun is potentially infinite, but also chemical-reaction energy, wind energy, hydraulic energy and atomic/nuclear energy. The $E=mc^2$ indicates that matter *per se* comprises a huge deal of energy; expressing the essence of metabolism. In other words, our ecosystem is only theoretically finite according to the first law of thermodynamics, but in practice, as we compare the scale of the available energy/matter, using Einstein's equation, to our current and future needs of energy - and by taking our ability of cybernetics into consideration, the system-capacity horizons opens up infinitely. But then the choices we make is what limit us.

I propose that growth is not itself the enemy. That the quality of growth is what matters and not necessarily its scale.

To sum up, unconstrained growth, if harmful, is likely to produce *disruptive* (to the natural cycles) and/or unusable waste rather than a "high entropy" one - as Daly claims. Entropy applies to systems and waste is not on its own-self a system. This may explain why in his criticism to Solow's model, Daly resorts back to the depletion of non-renewables argument: "You cannot burn the same lump of coal twice", which is of course a legitimate and a

serious concern, but is insufficient - as I argue (in support of Solow's point of view) to justify the employment of the second law of thermodynamic as a basic argument against economic growth.

Many of the "artifacts" produced as commodities are self-regulatory systems contributing to saving a critical amount of energy to the human organisation, which might support the idea presented by Solow that human-made capital may - in principle, substitute natural capital at a point of our technical advancement². The only thing that is irreplaceable so far is the organismic life representing biodiversity and this is hardly a commodity.

It isn't "magic" then or an "alchemist's dreams" as Daly puts it (see Garner 1995); it is the brain faculty of "*steermanship*" or cybernetics which has enabled us to "create" self-regulatory systems to complement our biological existence, and (ideally) share their efficiency through the monetary system (see IUCN redlist of endangered species- Homo sapiens), but which - nonetheless, has not been yet incorporated adequately into our (applicable) understanding of living systems, till we've reached a level of (global) social synergy (see Espejo, 2003; Schwaninger, 2004; Parra-Luna, 2009).

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*Umpleby, S. (2007) Physical Relationships among Matter, Energy and Information
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² That is not to criticise the ideas of downscaling unnecessary consumption or physical throughput, but to propose that the growth of physical throughput is not what growth necessarily comprises, as long as the efficiency of energy flow increases.

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ⁱ It has been famously proposed that 'Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist'. - *Kenneth Boulding – I'm here adding 'or a cyberneticist' in support of the evolved post-Keynesian models and green growth, highlighting the cybernetic perspective of economic systems in this respect.*