

TOWARD AN ECONOMICS OF PHYSICAL AND POLITICAL NEGENTROPY^{*/} (2009)

0. Dozens of weighty tomes have been written, after Marx and Karl Polanyi, about the hugely destructive effects of our rotting capitalism, so I can here only summarize a few most salient arguments about political economy, entropy, and our prospects today. When labour, nature, finally even money, bodies, and the future, are turned into commodities, then people are alienated and humiliated, the planet's resources recklessly squandered, and money subsumed under financial speculation. Human life has become extremely cheap: around 2,000 million people live today in the most abject poverty, which means more or less slowly dying of hunger and attendant diseases, facing the few thousand billionaires -- so that the hundred million dead and several hundred million other casualties of capitalist warfare in the 20th Century seem puny in comparison (though their terror and suffering is not). The purpose of the economy is profit, only profit, and nothing but profit: we see it bring about mass dying and unhappiness, shorter and much uglier lives, in order to achieve social pacification for the upper third of the Northern metropolis of global capitalism. The purpose of the economy clearly ought to be the survival of the human species and other species ecologically linked to us. Our run-away sciences, which could have finally made (as Brecht put it after 1945) this planet habitable, have been turned into providers of enormous quantities of commodities without regard to quality of life. Economic growth benefits "only the richest people alive now, at the expense of nearly everybody else, especially the poor and the powerless in this and future generations.... Life on planet Earth itself is now at risk." (Ayres 2) The "higher growth" of all our fake economical statistics is largely synonymous with more pollution, resource plunder, environmental and community destruction.

I shall deal in this paper with discussions about the relation of official income to actual well-being, continue with an indication of the entropy calculus as a basis for any future program of human survival, and conclude with some practical measures and difficulties of one such program.

1. On Political Economy: The Fake Instrument of GNP/GDP

1.1. One indispensable way to start is "the accounting assumptions at the very heart of industrial capitalism, the statistic known as the Gross National Product" (Greider 452), further GNP. It measures the yearly monetary transactions involved in the production of goods and services, the flow of money paid out by producers for all their costs: wages, rents, interests, and profits, also depreciation and excise taxes. It is founded on defining "capital" as the manmade assets producing goods and services, assuming nature is unlimited. Thus it ignores many costs, possibly the crucial ones, such as all the entropic costs -- to which I shall return -- of pollution and depletion of natural assets (not to speak of surplus extraction of value from workers). It further throws into the same bag useful and murderous goods and services. For example, any known monetary transactions in arms, drugs, prostitution, and crime, any repairs after natural or manmade devastations, unnecessary lawsuits or medical interventions, all count as increase of richness. Ridiculous paradoxes ensue: if prices fall, richness is officially reduced; if family help to the sick is monetarized by hiring a nurse, or if a family member's death is followed by payment of insurance, richness grows. Finally, GNP does not at all deal with "non-monetarizable" (unpaid) exchanges of services and goods -- not only the illegal "black market" of smuggling and immigrant work but also housework, leisure and volunteer activities, etc. -- which some accounts estimate at almost 2/3 of total work in industrialized countries (Möller col. 67-68). Therefore, the GNP's elaborate rows of numbers purporting to prove rising richness, and trumpeted ceaselessly by all world capitalist governments and media, conceal falling well-being and destruction

of nature. The happiest event for it is a multimillion-dollar hurricane or, even better, a multi-billion war. The GNP may have been a useful instrument to measure capitalist production at the beginning of the industrial age, but beyond a certain level long ago achieved by industrialized countries, it becomes simply an instrument of ideological brainwashing, a Disneyland for the economists.

Since the 2nd World War, the GNP (and then the GDP) became the official US government measure for policy. Nonetheless, pioneering demurrals against it were entered in the first half of 20th Century by Irving Fisher, John Hicks, and Kenneth E. Boulding, and the critique picked up steam from the 1960s on in Baran, Sametz, Nordhaus-Tobin, Economic Council of Japan, Zolotas, and culminated in various more encompassing proposals at the end of the 1980s (see for this history Leipert 55, 62-63, 68-72, and 331ff.). Most of them concluded that the GNP is not "even a reasonable approximation [of economic well-being]" (Nordhaus and Tobin, cited in Ayres 5), and proposed to modify it more or less drastically to achieve such an approximation. To the agenda of international politics this arrived only in the 1987 Brundtland Report on "sustainable development."

1.2. Systematic, reasonable, and fairly encompassing proposals for modifying the GNP by subtracting the real if hidden -- and therefore difficult to estimate precisely -- costs of life under capitalism began with Daly and Cobb's magnum opus *For the Common Good* (1989, rev. edn. with slightly less pessimistic calculations 1994). They proposed to effect not only a better measurement of real income but also to relate that income to what I am calling well-being^{1/} (welfare being by now associated with doling out). Accepting the framework of capitalism, proposals such as theirs were naively meant to sanitize its savage aspect. But insofar as they dealt with people's real well-being rather than their monetarized richness, they were more or less radical.

Daly and Cobb identify the GNP as mainly oriented toward measuring market activity but with modest adjustments in the direction of well-being, which it also claims to judge. Instruments like GNP are thus impure, a result of ideologico-political negotiation. (A good example is the Dow-Jones average, composed of 30 stocks selected secretly by *Wall Street Journal* editors!) The GNP is in de Goede's term a "contingent compilation" (89), though purporting to be based on the market, it uses for example the non-market accounting for capital depreciation (which raises the GNP: a total depreciation, the loss of all value to capital assets, would theoretically give a maximum rise to the GNP!). And since some GNP entries relate to well-being positively, some negatively, and some neutrally, Daly and Cobb concluded they can be extended to cover, say, depreciation of natural assets. By a series of such manoeuvres -- subtracting 13 categories such as environmental damage and depletion or foreign debt, and adding 4 categories that estimate household labour and some services (such as public expenditure on health and education) -- they arrive first at so-called Hicksian income, that is, what can be consumed without impoverishment in the future, and then at their estimate of well-being called Index of Sustainable Economic Welfare (ISEW). In order to measure consumption (well-being) rather than production (riches), they foreground the per capita amount arrived at (Table A1, 418-19). Here is their staggering difference with the GNP (all figures as US\$ per capita):

OFFICIAL GNP:	<u>1950</u> : \$3,512;	<u>1973</u> : \$ 5,919;	<u>1986</u> : \$ 7,226
DALY-COBB'S ISEW:	<u>1950</u> : \$2,488;	<u>1973</u> : \$ 3,787;	<u>1986</u> : \$ 3,403

This means that the US per capita income, recalculated to measure well-being better (but still not centrally oriented to use-value) passed since 1961 through two phases: 1961-73 it did not rise (as the GNP falsely claims) 44% but did rise 26%, still a considerable achievement; 1974-86 it did not rise 24% but fell 9%! Thence, the average US well-being was in 1986 back to where it was in the mid-1960s. Today, if the pumping of hundreds of billions of \$ paid by the working people, first into the US military expenditures and then into saving rapacious banks, were also subtracted, the index of well-being would be back at the 1930s...Income inequality is back at 1929, with the top 300 thousand

people earning as much as the bottom 150 million (Talberth 20)!

In 1991 the GNP was renamed GDP (Gross Domestic Product) in another politically contingent government manoeuvre. In 1995 a group including Cobb refined their counterproposal further. They proposed a refurbished Genuine Progress Indicator which includes 20 items more than GDP: it added the value of household and community work, and subtracted for a rising income gap, pollution costs or "defensive expenditures" offsetting damage by crime and other reasons. Their conclusion was, to begin with, that the GDP is mainly "three things in disguise: fixing blunders and social decay..., borrowing resources from the future or shifting functions from ... household and community to monetized economy" (Cobb et al.). Furthermore, that in the later 1990s this GPI index showed a roughly 45% decline in genuine well-being as compared to 1973 and in 2004 it was \$4,419 billion as compared to a quite unreal GDP of \$10,760 billion (Talberth 22). This ludicrous situation prompted in 2007 even the OECD and European Commission to convene a conference called "Beyond GDP," but its results remain to be seen.

Quite beyond even the heterodox US economists' and ecologists' horizon (bar very few), subtracting from GDP the income of the upper (say) 2% would disastrously lower the per capita for the 98% that remain. Even the GPI index vastly exaggerates the well-being of between 80 and 98% of people (depending on nation).

In sum: capitalist growth since 1973 -- the onset of Post-Fordism -- impoverishes the great majority of US people in terms of human well-being. This would hold *a fortiori* for most other countries of the North, except a few with remnants of the welfare State, while for the South, that is three quarters of mankind, the abyss of poverty for the majority grows daily larger.

This is largely to be understood as capitalist refusal to be accountable for the "social costs" of a profit economy, defined by Kapp (chapters 4-9 and 13) and added to by Leipert (89-91 and *passim*), as those costs caused by capitalist producers but not paid by them. They are manifest in the avoidable damages, for example to human and animal health or to natural resources. If such "costs of social consequences" — including the "societal illnesses" due to pollution such as cancer, heart, and blood circulation, and breathing ways ailments — are figured in, the conclusion is that in a society based largely on "brain labour," the ability to buy more regardless of all other factors influencing life -- for example, the GNP/GDP -- is a poor measure of well-being. Beyond a certain medium level of industrialized mass production and an income of ca. \$10,000 per head the official economic growth proves nothing: it "reflects increasingly frantic activity, especially trade, but little or no progress of human welfare in 'real' terms (health, diet, housing, education, etc.)" (Ayres 2, and cf. 2-5 *passim*). It is dubious also whether increase of competitiveness -- the ideology of capitalist globalization -- significantly contributes to well-being. "Sustainable economic growth" as defined by the capitalist roof organizations and governments is an oxymoron: growth raises the GNP but most probably damages at least as much as it improves well-being. Daly therefore rightly concluded that quantitative economic growth is ecologically not sustainable, so that total consumption must be reduced and stabilized (Daly, *Beyond* 10-11). Qualitative "growth," that is, efficiency of resource use, can and should be favoured. Even such a political babe in the woods as he concludes that the WTO-WB-IMF domination must be broken.^{2/}

2. On the Entropy Calculus

2.1. Of course, there can and must be sustainable development in the sense of a "qualitative improvement without quantitative growth beyond the point where the ecosystem can regenerate" (Greider 455). For here we pass beyond tinkering with exploitative and destructive economics to consideration of ecology and survival, where the aim changes from maximum to optimum production. The ideologized commitment of the world's capitalist governments and corporations to infinite growth

on a finite globe collides with the elementary fact that "[a]ny physical system of a finite and nongrowing Earth must itself also eventually become nongrowing" (Daly-Cobb 72). It follows that the major focus must be to optimize production by raising the productivity of its scarcest element -- today, the natural resources. This is possible to achieve only if the real social costs of using air, water, soil, and labour are figured in, and unproductive consumption (most marketing and PR, useless innovations, artificial obsolescence, unceasing turnover of fashion trends, and other similar activities extraneous to use-values) is rigorously taxed. This means that both population growth in the poorer countries (the South) and per capita consumption in the richer countries and classes (the North) must be strongly, if reasonably, curbed. (The only fair and efficient way to curb population growth is, of course, making the poor richer -- that is, meeting poverty head on rather than deepening it as the capitalist globalization does.) Their common denominator is the total consumption of energy. However, I shall vault over the intermediate discussion of energy (cf. Georgescu-Roegen, *Entropy* 138-40, and McNeill, 15 and *passim*), or even Einsteinian matter-energy, however eye-opening its consequences would already be, to focus on what seems to me the furthest reach of today's discussions: the management of entropy.

Entropy, the central term of thermodynamics, is usually explained as the inverse measure of the energy available to do work, but it is trickier than that. As Georgescu-Roegen's pioneering text from the 1960s (which I gloss in this section) points out, the Second Law of Thermodynamics means that the entropy of any isolated structure increases not only constantly, but also irreversibly (6). Since life is tied to activity, any life-bearing entity survives by sucking low entropy from the environment, and thereby accelerating the transformation of the environment toward higher entropy. The Entropy Law founds a different physics: it leads away from motion, which is in principle reversible, and opens onto irreversible qualitative change. It has no time quantification -- how fast X will happen -- and no particularization or specification -- exactly which X will happen at any particular point (10-12 and 169). Thus, beyond being a branch of physics dealing with heat energy, thermodynamics underlies any biophysics of life and activity (including thinking).

Life is obtainable only by paying always a clear price: the degradation of the "neighboring universe" or total system -- for example Earth. "[A] given amount of low entropy can be used by us only once" (278), so that "the basic nature of the economic process is entropic" (283). Since any collectively significant activity must be paid in the coin of less chance for future activity, the importance of purpose, what is something done for, becomes overwhelming. Aristotle's final cause and the old Roman tag *cui bono?* (in whose interest?) are rehabilitated as against scientism's narrow concentration on the efficient cause, how to manipulate matter (194-95).^{3/} If, as the Second Law of Thermodynamics recites, the entropy of the universe at all times tends toward a maximum, then we are in the domain of "a physics of economic value" (276). For, "low entropy is a necessary condition for a thing to be useful" (278): for example, copper in a bar has much lower entropy than copper diffused in molecules, or coal than ashes. Now, the economic process is, regardless of local fluctuations, entropically unidirectional: it will always be generating irrevocable waste or pollution, and foreclosing some future options (use of oil after it has been burned). Since, however, it also generates not only life but also all possibilities for "enjoyment of life" (281-82), we must become careful stewards, on the constant lookout for minimizing entropy or increasing negentropy.

Minimizing entropy centrally means that we must switch from the present use of terrestrial energy (oil, gas, and coal) to solar energy, which we get from outside the Earth system. The proportions in the mid-1980s were oil, gas, and coal 82%, nuclear 2% (its very dubious use depends on both safety and the entropic cost of waste disposal), renewables 16% -- and today it is probably worse. This has already brought upon us the climate change only hired guns in science pretend not to notice, with economic damages on the order of untold billions of dollars which will be rising geometrically (but the foot-dragging capitalist combatting of which uses up even more energy, raising the entropy -- and the GDP!). And since solar energy is huge -- all terrestrial stocks of energy (low entropy) are equivalent to four days of sunlight -- and practically free except for the initial cost of R&D plus

installations, yet limited in its yearly rate of arrival to Earth, the preparations for the increase of its proportion in our energy consumption, which is the only alternative to a civilizational crash, should begin as soon as possible. Photosynthesis is our best bet, and if gasoline need be used for limited purposes, it should be gotten from corn instead of feeding it to cattle (cf. 304). Our wars for oil are a testimony not only to gigantic cruelty but also to gigantic imbecility and a lemming-like suicidal urge among our leaders and their brainwashed followers.

3. A Basic Prospect

So what is to be done? Again I can only mention a few general orientations towards maximizing life.

3.1. An idea by Georgescu-Roegen could be developed into a pleasing calculus of preconditions for felicity. He pleads for a "maximum of life quantity," defined as the sum of all the years lived by all humans, present and future, and stresses it "requires the minimum rate of resource depletion" (*Entropy* 20-21). We could refine this, possibly by adding past humans too, certainly by specifying minimum conditions of dignified life, etc. Clearly the goal is *a maximum stock of life quality*, but quality presupposes a minimum quantity. Since this is an anti-entropic (negentropic) enterprise par excellence, a move toward it would have to include a shift to an economics of stewardship not ownership (cf. Brown), such as seems to have obtained before class society. The biosphere is indispensable to human physical and psychic survival, even beyond the need for photosynthesis. The flourishing of humanity is predicated on a substantial decrease of the human ecological niche as well as of the human boosting of entropy (cf. Daly-Cobb 378). This ties into the diminution and eventual elimination of dire poverty, since desperation cannot be expected to spare the environment -- for example, locate farming where it does the least ecological damage. Such orientation toward a maximum of use-values compatible with a low rise of entropy must override all globalization based not only on financial speculation but also on the sole goal of profit.

Various sets of measures will be necessary for this, and have been for years now debated by some writers and in the "new global" movements.

3.2. The ecological imperative to focus on use-values instead of exchange-values brings us, finally, back to Marx's living labour (cf. Suvin, "Living"). For this is the only horizon against which a serious change of social formation can be again envisaged, if in circumstances radically different from the 19th and also from the early 20th Century. I shall proceed, I hope in his spirit, by indicating some medium-range necessities, some practical difficulties, and a horizon for overcoming them.

To prevent economic breakdown, indeed civilizational crash on the scale of the fall of Roman Empire 17 centuries ago, we need to implement what Georgescu-Roegen called "a minimal bioeconomic program." He opined it would have to include "lower[ing] the population to a level that could be adequately fed only by organic agriculture" (today we'd have to add: without the OGMs) and strict regulation of energy wastage "by overheating, overcooling, overspeeding, overlighting, etc." ("Energy" 33-34). A third of a century and untold destructions later, Serge Latouche summed it up in the slogan of *décroissance*, meaning a lot of terms with "re": revaluing, reconceptualizing, restructuring, redistributing, reducing, reusing, recycling... (Latouche passim). The latest banking mega-bubble of 2007-08ff. has alerted us to the absolute necessity of mastering the "[b]usiness cycles... due to financial attributes that are essential to capitalism" (Minsky 173). Capitalism is not only a social system where all major means of production are privately owned, the key ones by a few dozen mega-corporations, but also a system of plutocratic power making a mockery out of democracy. An entity maniacally focussed on immediate profit, as any capitalist must be, is at best indifferent but usually actively opposed to public well-being. This system cannot be abolished overnight, but we have

seen in the Welfare State period ca. 1940-73 that it can be up to a point controlled by a strong radical democracy. True, finally Samir Amin is on the right track when he states that the present crisis of misery and ecocide cannot be overcome within capitalism and yet must be overcome if we're not to fall back into barbarism (114) -- or perhaps a genetic caste society.

Here are some possible initial policy measures which use, and modify, suggestions by Georgescu-Roegen, Minsky 287ff. and 328ff., the Tilburg Declaration, Greider, and others:

- Investment into production of use-values, from shoes through machines to good movies, which would strive for high productivity but not high profitability, meaning it would usefully employ the maximum possible number of willing people.
- Gathering means for such investments and other necessities of a radical democracy by progressive tax revenue on profits and ecological damage rather than on labour, and in favour of sustainable energy uses -- for example: a tax on all built-over land, on consumption of water and minerals, and a tax on nuclear power to cover all expected costs of security and waste disposal (which would probably make their use uneconomical). This should include a large tax on incomes surpassing the legal minimum wage (say) more than tenfold, and a simultaneous reduction of taxes for the great majority of people. It is important that the taxes strongly encourage all suggestions for limiting risks by new products, for precautionary steps before prevention (Kourilsky and Viney, cf. Testart 23-25 and Suvin, "Horizons").

The revenue from such taxes will have to be a multiple of the present revenues which amount to \$7.5 trillion per year: "A carbon tax on coal, oil, and natural gas alone could raise roughly a trillion \$ per year worldwide. That revenue could pay for a 20% cut in conventional taxes—on wages, for example." (Roodman 6-7) There are ample precedents to this; for example: "since 1991, five European countries have taken the seminal step of combining environmental tax hikes with income or payroll tax cuts" (Roodman 8, and see further illuminating examples there).

- To measure this, abandon the GDP and reformulate the meaning of sustainable growth in all our public statistics is another necessary prerequisite. "[T]he GDP not only masks the breakdown of the social structure and the natural habitat...; worse, it actually portrays such breakdown as economic gain" (Cobb et al.). The use of converging indices such as Daly-Cobb's ISEW, the GPI by Cobb et al. -- or the Ecological Footprint Analysis (EFA) that measures depletion of "natural capital," and at the moment indicates we would need 1.25 Earths to sustain the present rate of consumption (Talberth 24) -- would educate the public as to the more realistic costs of what we do. It would also open the door for recognition and tax support of "activity by and for a collective" and a "community-oriented economy" (Möller col. 71-72): the unpaid work in the family or elsewhere taking up more time than the paid work (especially among women — cf. also Delphy, Haug, and Mies-Shiva).

- Reduce the working time for a living wage per week to 35 hours. Working time is a good rule-of-thumb measure of exploitation. In the last 35 years this has grown hugely, at the direct expense of human health and lives in tiredness, stress, disease, etc. The French Socialist Party's proposal for a 35-hours' week had the right idea but, as most social-democrats, they had no real will to defend it. This holds for the North and has to be accompanied *pari passu* with the urgent alleviation of poverty in the South by introducing work for a living wage and social protection there. Without an alliance between radical democracy in the North and South of our globe, in the long term both will come to nothing. The huge and hugely growing inequalities between them would remain the breeding ground of group terrorism responding to State terrorism.

One major difficulty would immediately arise. Some reformers (the Tilburg group, some ecologists) propose two simultaneous points. The first is that a radical economic reorientation for more affluent countries, including (say) the reduction by two thirds of consumption in key materials such as fossil fuels — some ecologists envisage a gradual reduction of materials and energy flow by 10 times! -- will protect us from even bigger future problems, such as health hazards, environmental degradation,

a further increase in the global poverty gap, armed conflicts and refugee movements: I find this fully correct. The second point is that this will not bring about a decrease in human welfare: I believe this is correct only a/ if by welfare one means happiness (well-being) rather than financial wealth, and b/ in the long run, but not necessarily at the inception of such a reorientation. For capitalism functions by distancing the privileged Northern consumer from the true costs of production. Let me take the clearest case of energy prices in the North. As Kapp, Leipert, and others have argued, the Northern consumer buys not only the commodity "energy" but also the hidden decrease of ecological quality (deaths, diseases, costs of "defensive measures") destroyed by its production. The ecological replacement cost has to be added to the energy price, or entropy will spiral away and the sporadic crashes of our energy supply will grow systematic. Figuring in such costs was in the 1980s calculated as adding, for densely populated industrialized countries, up to two thirds of the present prices (Leipert 32-33 and 39-40, and cf. Greider 446 and passim). The case of energy can be extended, perhaps less starkly, to other instances of what William Morris called the unnecessary offers of the market.

Thus both gradual implementation and constant care for large majority support would be a necessity. As to the second, our horizon of radical democracy shall necessarily have to mix forms of representative, associational, and direct democracy (including recall of all elected representatives by proper procedures — cf. Cohen and Rogers). A permanent societal organ aiming toward sustainability and solidarity would be necessary, which in order to be effective would have to be elected and constitutionally on a par with other parliamentary houses — let me call it an "Ecological Senate." As to gradualness, the *décroissance* must be well planned so as to avoid chaos. An example of a very simple and minimal step towards sanity was the 1980s' proposal of the "Tobin Tax," a small exit-and-entry toll at major foreign-exchange centers, which would greatly reduce the unproductive daily speculation in money values and yield hundreds of billions of dollars for good purposes (Greider 257, cf. Nordhaus and Tobin). But more important, implementing the above measures and major tasks of politically educating working people into their necessity and final superiority — such as persuading a family to pay 165 dollars or euros or pounds instead of 100 in order to save our planet -- would be impossible without access to State power and thus to the mass media. This means reasserting political governance (where possible international, where need be national) over capital; an old-fashioned and entirely legal way of doing this is by taxing the worst corporate entropy-mongers more and restoring purchasing power to the middle and lower classes by taxing them less (cf. Greider passim).

One should expect huge opposition to all of this, since major corporations would spend half of the billions they fear to lose from their destruction of people and our planet to suborn efficient opposition to it, on the model of the destruction of Allende in Chile. It is not necessarily the fact that a program implementing significant ecological and societal justice measures could, as Wallerstein has remarked, "well serve as the coup de grâce to the viability of the capitalist economy" (81). Some capitalist enterprises could well and justly profit (within reason). Nonetheless one possible outcome would be a "transition beyond capitalism" as the only alternative to hugely destructive class warfare on all social levels (Amin 85). I do not think this can today be anybody's immediate program, as opposed to a coexistence with some segments of capitalists à la New Deal. But we have seen military destruction brought upon Serbia, Irak and Afghanistan by the US government, which has taken upon itself the role of the executive committee of the world capitalist classes, when much smaller and further-off threats were perceived. I have remarked upon the political naivety of proposals such as Daly-Cobb's: this was perhaps tolerable at the time of President Carter, but is not today. In particular, Greece has had the experience of the Colonels' terror rule. Thus, in the case of active subversion, democracy will have to defend itself as best it knows, in ways we cannot foresee.

Notes

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1/ Today, the uselessness of GNP is well established in professional discourse, and there is a plethora of further instruments, surveyed in Talberth. The estimate of the Iraq invasion costs by Stieglitz is at least 3,000 billion \$, and at least as much was pumped by the world governments into the banking system in the last two years.

2/ A good initial formulation of human welfare in the sense of well-being is in Ruskin's *Unto This Last*: "There is no wealth but life. Life, including all its powers of love, of joy and of admiration. That country is the richest which nourishes the greatest number of noble and happy human beings; that man [sic] is richest who, having perfected the functions of his own life to the utmost, has also the widest helpful influence... over the lives of others." (cited in Hobson 4-5)

3/ See an epistemological approach to scientism as inimical to life in Suvin, "Horizons."

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