

Entropic Complex Apocalypse Dialectic

Ted Dace

Downstream from Niagara Falls, a whirlpool has been draining H₂O through its revolving eye since time immemorial. So lifelike is this autonomous force of suction that it earned its own name. Yes, “Whirlpool” has a story to tell. The message emanating from its hypnotic swirl is both a warning of what happens to societies that defy nature and an illustration of what we must do to get back on track.

Ecologist Eric D. Schneider saw the writing on the rippling wall back in the '70s. In search of a theoretical framework by which to comprehend the ecosystem collapses he witnessed in the course of his fieldwork, Schneider ran across the emerging science of nonequilibrium thermodynamics (NET). At the crossroads of physics, chemistry and biology, NET explains how complex systems ranging from whirlpools to human economies maintain themselves despite being out of equilibrium with their environments.¹

By human logic, complexity is what you get when you compound simplicity. Nature begs to differ. Far from being built up gradually from simpler elements, complex systems emerge all at once in totality. Whirlpool isn't just bits of matter blindly hurled about by abstract laws of nature but a spontaneous self-creation that lives to channel energy. All that was needed was a slight stirring of the waters eons ago, and it sprang into action. Its energy is derived from reducing the pressure gradient that results from Niagara-sized sheets of water trying to squeeze through the opening at the bottom of its basin. By rapidly closing the gap between where the water is and where it “wants” to go, Whirlpool is energized with spiraling lines of force that flush out water over 30 times faster than simply letting it drop straight down the hole.²

If there's an idea in the mind of nature, it's that gradients are bad. Wherever there's a gap, nature rushes to close it. When the air becomes segregated between warm and cold pockets, excited molecules are drawn into cooler areas, gradually wiping out the gradient. Better yet, complex weather systems like tornados and hurricanes eliminate temperature gradients with stunning efficiency, bursting into existence like a bolt of lightning equalizing the electrical charge of ground and sky.³

The natural tendency toward even dispersal is called entropy. You'd think life, which specializes in concentrating energy, could never appear in a universe where entropy is the “rule of rules.” Yet nature approves of anything that rapidly reduces gradients. As Schneider

and fellow author Dorion Sagan explain in their whirlwind tour of NET, *Into the Cool*, organisms are simply gradient-reducing chemical systems that have evolved the twin capacities of storing energy and reproducing. Nature loves life so long as living things procure their energy by reducing concentrations of it in the environment.⁴

But when organisms themselves become concentrations of energy, they have a problem. Now nature wants to extract it from them, and this tendency is measured by the amount of waste they produce. So, for instance, as a tree draws in energy during growth, it must expel increasing amounts of it in the form of heat. Animals have more elaborate disposal methods because they have greater concentrations of energy flow, while garbage and pollution reflect the immense energy flows in human economies.⁵

The solution to energy loss due to entropy is the evolution of ever more complex structures that improve the efficiency of both energy capture and waste export. But the increasingly delicate, fine-tuned systems that result are also increasingly out of balance with their environments and therefore require more energy to maintain their structure. For this reason the history of life on Earth, including human civilization, is characterized by long periods of gradually increased complexity punctuated by sudden and devastating crashes.⁶

“Life,” say Schneider and Sagan, is a “cycling system whose physical, material, and ultimately mundane purpose is to get rid of prior complexity.”⁷ The degree of complexity attained in the past determines the degree of waste the current system must eliminate to avoid getting backed up. If you can't process the waste from yesterday's developmental achievement, you must draw in more energy, setting up an even bigger disposal problem for tomorrow, and so on.⁸

According to archaeologist Joseph Tainter, civilizations aren't brought down by invasion or environmental calamity so much as the weight of their own prior development. In Rome, the conquest of distant lands fed the treasury while it took place but turned into a drag over time as the bureaucracy of empire bloated. Like a pyramid scheme, new conquests paid for the maintenance of already conquered territories. Once the boundaries were set—largely under the reign of Caesar Augustus—the seed of collapse was planted. The moment the ink was dry on the map, Augustus had to levy new taxes to make up for shortfalls in revenue. Over the following cen-

turies, the continent-spanning infrastructure of cities, roads, ports and waterways, which had set off waves of prosperity as it took shape in the wake of conquest, became gradually more dilapidated and expensive to maintain. The tax burden on peasants got so severe as to drive many into bankruptcy and slavery. With the loss of countless farms, the tax base shriveled, necessitating higher rates on those that survived. A self-perpetuating cycle was unleashed that ravaged the empire far more effectively than hordes of barbarians ever could.⁹

Tainter's entropy-informed analysis dovetails nicely with Marxist economics. The greatest strength of capitalism, according to Karl Marx, is also its lethal flaw. So efficient is this complex system at generating wealth, investors eventually run out of profitable outlets for it, producing a kind of economic constipation and periodic crashes. As in the thermodynamics of life, yesterday's achievement becomes a burden that must be overcome by today's gains. "If capital increases from 100 to 1000, then 1000 is now the point of departure from which the increase has to begin... What appeared as surplus-value now appears as simple presupposition."¹⁰

Just as energy flow generates complex organic forms, circulation of money stimulates production and distribution of goods. And just as chloroplast obtains energy for plants by tapping into the temperature gradient between sunlight and space, merchants derive wealth by exploiting the gap between what people have and what they want. The invisible hand of the market is nature's own. Capitalism works because it's natural.¹¹

Or is it? Sure, you want energy flow but not so much that you drown in the waste accumulating in its wake. As they mature, ecosystems switch gears and become dominated by slow-growth plants, which extend lifespan by using energy more minimally and efficiently than the rapidly growing species they displace.¹² Forever stuck in the fast-paced juvenile phase of development, capitalism is unable to switch gears to a sustainable rate of energy harvesting and waste processing.

If the economy were simply about earning money through the exchange of goods via free markets, there'd be no crisis. But that's only the myth. The reality of capitalism is the struggle to dominate markets in order to accumulate power, both economic and political. The more that markets are monopolized by corporate cartels, the more that power is centralized in the form of energy-intensive hierarchical infrastructure. So long as the rich must compete to accumulate capital while the rest of us must struggle to make ends meet, no one is free to step out of the flow and alter its course.

Under the reign of capital, we are never more than a step ahead of being swamped by the entropy accruing from prior overdevelopment. Locked in a hell of our own making, we must constantly accelerate money flow and maximize development, be it through conquest and colonization, intensified exploitation of labor, technological advancement or increasingly exotic financial

instruments such as the "subprime mortgages" and "collateralized debt obligations" whose implosion threatens to drive the global economy into the dirt. No matter how close the system takes us to meltdown, it always wants to push it that much further.

What makes capitalism self-perpetuating is its bipolarity of upper and lower class. Just as Whirlpool feeds off the pressure gradient resulting from a large body of water trying to fit through a small opening, capitalism feeds off the gradient caused by a large body of impoverished people trying to live a decent life. The key to capitalism is exploitation, the process whereby those who already have lots of money make even more at the expense of those who have virtually none.

As social critic Andre Gunder Frank (thermodynamically) reasoned some years back, modern poverty is not a leftover of some mythically all-impoverished past but is actively created as a kind of toxic byproduct of class development. Paradoxically, upper class and lower class are held at bay via the energy unleashed by tapping into the gradient between them. As Frank puts it, the "development-underdevelopment contradiction... is the source of its development throughout."¹³ Exploiting the poor perpetuates their poverty and therefore the wealth gap that powers the system. In order to maintain the gradient off which it feeds, the system must merely continue feeding off it.

So long as Niagara falls, Whirlpool makes room for more. The energy that keeps it spinning is no different, fundamentally, than the self-perpetuating flow of resources from poor to rich. Throughout the global South, wealth is continually vacuumed up, whether via mining and monoculture, cheap labor for foreign-owned factories or interest on endlessly revolving debt. As surely as Whirlpool reproduces the conditions required for its survival, the money-driven economy perpetuates the wealth gradient.

In short, capitalism sucks. The alternative, by definition, is socialism. Rather than dividing society into one part that benefits at the expense of the other, a socialist economy operates for the benefit of society as a whole. Socialism can take many possible forms, some workable, others perhaps not and still others even worse than what we already have.

The very worst kind of socialism is what Lenin and Stalin imposed on Russia after 1917. State-sponsored communism seeks to equalize wealth by way of rapid, centrally planned development. Though devoid of the life-or-death competition that drives centralization in the capitalist world, communism arrives at the same end by simply transforming the state into a single mega-corporation that makes all economic decisions. The state corporation hires the entire workforce, grows all the food, builds all the housing and manufactures all the products its consumer-citizens must buy at its stores. Communist logic is impeccable. Unfortunately, it's our logic, not nature's.

As the people of the Soviet Union learned, nature isn't shy about humbling those who concentrate too much energy and build up too much infrastructure all at once. All that development starts falling apart at the same time, and the system is crushed under its own weight.

Activist and author Michael Albert has attempted to take the Stalin out of Stalinism by proposing a system known as participatory economics, or *parecon*, which relies on centralized, state-organized production but utilizes the internet to allow ordinary people to vote on what they'd like the state to produce and at what price.¹⁴ But no matter how democratic or participatory such a system is, it will always be thermodynamically incorrect. Though warped under the weight of capitalism, the market is still a vastly more efficient way of determining production and pricing than planning every economic output down to the last detail.

Let's say a patch of warm air congregates at ground-level under a heavy blanket of cold air. Nature is unhappy. Now let's say all that warm air is abruptly funneled into the sky, equalizing the temperature almost instantaneously. Without any planning, preparation or even announcement, a tornado has simply popped into being and gotten the job done. Nature is pleased. But if it were up to Albert, that tornado would be assembled one speck of dust at a time, the location, direction and momentum of each particle to be determined by popular vote. Even if it ever got off the ground, such colossal inefficiency couldn't even stir up the frosting on a cake.

Rather than follow up the tragedy of Stalin with the comedy of Albert, perhaps we should take the lead of mathematician David Schweickart, who advocates market socialism, according to which all productive enterprises are controlled by the people who work for them. Workers determine every aspect of how a company operates, right down to their own pay. Nobody can buy their way into ownership of a company because no companies are up for sale. The public owns while the workers manage. As Schweickart puts it, market socialism "maintains a competitive market for goods and services, but replaces the labor market with workplace democracy and the capital market with social control of investment."¹⁵

Capitalism exploits labor by subjecting workers to market logic. Because they don't own the means of production, workers must compete to sell their labor at the lowest possible price to the people who do. By eliminating this market but keeping the one for products, Schweickart would banish exploitation while retaining market efficiency in production and allocation. No more exploitation means no more wealth gradient and no more energy source for unlimited growth. The economy, at last, would be allowed to mature into slow-growth, long-term sustainability.

Or would it? From a thermodynamic point of view, the basic problem remains. Though worker-controlled,

the new system would be exactly as overcentralized as it is now, still requiring so much energy flow that the resulting waste couldn't be eliminated without further growth and greater energy flow. We would still be on the same cycle taking us to the same old scrap heap of failed civilizations.

Albert and Schweickart both depend on the emergence of a political movement so powerful that it can force the outlaw of privately owned productive property, an event unprecedented in the West. So long as politicians are bought and paid for by corporations, which also happen to own the major media outlets, capitalism would seem to have a lock on government policy.

Perhaps when the complexity crisis brings us face to face with imminent economic and ecological destruction, we will finally come to our senses and adopt some form of socialism. But here again we run headfirst into NET. As Schneider and Sagan point out, organisms don't generally start acting more intelligently in the face of overwhelming stress. Instead they regress to a primitive form of organization, like amoeba sacrificing their individuality and reverting to a collective organism that operates strictly according to its survival imperative.¹⁶ In the realm of human society, this roughly translates into fascism, a police state that maintains private wealth at all costs.

Locked into growth and complexification, our economy is unable to change course. Like sick and wounded creatures cranking up the energy influx just before the end, the system seems fated to feverishly cycle its way to final collapse.

Our challenge is to cultivate a socialism that not only operates but *emerges* thermodynamically. It begins with a stirring of the waters, so to speak, triggering the emergence of a wholly new economy complete with a new energy-producing gradient. A social economy—already incipient in the form of producer co-operatives, intentional communities and alternative currencies—has the potential to exploit the inherent inefficiency of a system which, in the process of concentrating power, renders masses of intelligent people into unthinking consumers and exploited laborers.

Just as capitalism generates the wealth gradient that fuels its cancerous growth, the social economy produces an efficiency gradient between itself and the overcentralized, mindless machinery of the dominant system. In contrast to the capitalist compulsion to increase production and consumption without limit, the social economy is based on judicious use of resources to achieve the good life. Decentralized organization serving the needs of society is inherently more efficient than centralized organization serving to maintain its own power.

The idea of a self-propelled organic socialism has been in the air for a long time. Something like it was proposed by Marx's contemporary, Pierre-Joseph Proudhon, which he called *mutualism*.¹⁷ So why, as Schweickart wonders, hasn't the social economy popped

into being by now? Apparently it doesn't come easily. Just as complex chemical systems had to evolve to a high degree of efficiency before giving birth to life, a great deal of development and monetary infusion will be needed to turn a network of co-ops and communes into a coherent system of production and exchange capable of converting its efficiency edge into long-term growth.

It's not as if we have to create *ex nihilo* a fully autonomous economy. Yes, it must be self-sufficient but only to a degree. To the extent that we produce our own goods, we gain efficiency relative to the system at large. But only to the extent that we trade with the corpulent system—selling surplus and buying what we don't make ourselves—can we cash in on that efficiency gap, earning the money that fuels our metabolic expansion. As the social organism propagates and extracts increasing amounts of energy via the efficiency gradient, the wealth gradient dries up, killing off capitalism at the source.

The key is to stop thinking in terms of simple abstractions—markets vs. socialism, private vs. public, daily life vs. political activism—and start thinking like nature. Revolution is the culmination of a dialectic whereby economic development enables greater political muscle, which opens the door to further development, and so on.

This is precisely the dialectic that brought the capitalist whirlpool into being, and this is how it will be drained. Screaming over the swirling roar to demand change is no better than dropping a bomb or two on it. Until we shut off the water supply, it will keep on spinning.

Notes:

1. Schneider, Eric D., and Sagan, Dorion, *Into the Cool: Energy Flow, Thermodynamics and Life*, Chicago: University of Chicago Press, 2005, pp. 1-4
2. *Ibid*, pp. 111-116
3. *Ibid*, p. 6
4. *Ibid*, pp. 145-146
5. *Ibid*, pp. 43-45, 208
6. *Ibid*, p. 210
7. *Ibid*, p. 323
8. *Ibid*, p. 328
9. Tainter, Joseph, *The Collapse of Complex Societies*, Cambridge: Cambridge University Press, 1988, pp. 128-150
10. Meszaros, I., *Beyond Capital*, New York: Monthly Review Press, 1995, p. 521
11. Schneider and Sagan, p. 276
12. *Ibid*, p. 158
13. Frank, Andre Gunder, *On Capitalist Underdevelopment*, Oxford: Oxford University Press, 1975, p. 44
14. Albert, Michael, *Parecon: Life after Capitalism*, London: Verso, 2003, pp. 9-12
15. Schweickart, David, "Nonsense on Stilts: Michael Albert's Parecon": <http://homepages.luc.edu/~dschwei/parecon.htm>
16. Schneider and Sagan, pp. 207, 287, 295
17. Gambone, L., "Proudhon and Anarchism: Proudhon's Libertarian Thought and the Anarchist Movement": <http://www.spunk.org/texts/writers/proudhon/sp001863.html>

Ted Dace, who now lives in Manhattan, Kansas, says: "At the age of 12 Ted Dace dreamed he was sitting on a plain wooden chair in outer space with a perfect view of Earth, which was apparently broken in some way because he could hear his parents arguing about why he wasn't doing anything to fix it. Since then, he's been trying to figure out a way of fixing it."