Thermo/Gene Collision

On Human Nature, Energy, and Collapse

BY JAY HANSON

> "Is there meaning to life? What are we for? What is man? The point I want to make now is that all attempts to answer that question before 1859 are worthless and that we are better off if we ignore them completely.
>
> —G. G. Simpson

Introduction

And I looked, and behold peak oil: and his name that sat on him was Death, and Hell followed with him. And power was given unto them over the fourth part of the earth, to kill with sword, and with hunger, and with death, and with the beasts of the earth.

If you were born after 1960, you will probably die of violence, starvation or contagious disease. Although it's news to you, your generation is challenged with a technically-insoluble problem—*a political problem*—which will ultimately kill five out of six worldwide—or perhaps all. You can not solve this problem because that carbon-based, selfish-gene rational computer on your neck isn't logical!

This paper will attempt to describe the least-known major biophysical laws at work in modern society and extrapolate them into the near future[1]. These biophysical laws are now "politically incorrect" and suppressed from public discourse, *but that doesn't mean these laws don't exist.* What will our lives be like, when changes in our energy supply radically change the *energy context* in which we live? We need to understand how we will make decisions when thermodynamic laws (allowing for less-and-less) collide with genetic drives (demanding more-and-more.) This is the "thermo/gene collision."

***Jay Hanson**, the author of numerous articles on energy, peak oil, and the environment, manages the website: dieoff.org.*

Key Terms and Metaphors

"Gene" in this paper means that part of the genome which produces a specific appearance or behavior. "Environment" in this paper means everything except a gene.

Following Richard Dawkins' "Selfish Gene" metaphor[2], we will look at some concepts as though the *genes* themselves are actors rather than the animals they inhabit:

> "It rapidly became clear to me that the most imaginative way of looking at evolution, and the most inspiring way of teaching it, was to say that it's all about the genes. It's the genes that, for their own good, are manipulating the bodies they ride about in. The individual organism is a survival machine for its genes."
>
> —Richard Dawkins

Evolution conserves genes, not individual animals. Genes can survive many generations of individual animals before they go extinct, either because a more "adaptive"[3] gene appears in the animal population or because the host animals go extinct.

Appearance Selection

An English moth is an example of natural selection for physical appearance. A single gene primarily determines whether the color of this moth is light or dark.

Prior to 1848, dark moths constituted less than 2 percent of the population. But in the late eighteen hundreds, soot from English factories darkened the normally light-colored birch trees the moths landed on. Against a dark background, birds could see the

light-colored moths and ate them. As a result, more dark moths survived to reproduce.

By 1898, 95 percent of the moths in Manchester and other highly industrialized areas were dark. So, the change in frequency of dark-colored moths represented a change in the gene pool. This change was, by definition, evolution. The increase in relative abundance of the dark type was due to "natural selection" (i.e., selection by environment).

Our moth example shows how a specific *appearance* was selected by the environment. The environment selects genes for appearance that deliver the most copies of those genes into the next generation. The same selection criterion applies to genes which influence our *behavior*.

Evolutionary biologist and popular science writer Richard Dawkins

Behavioral Selection

> "A hen is only an egg's way of making another egg."
>
> —Samuel Butler

Our individual behavior derives entirely from our genes and our environment (defined above). We begin our lives with genes that were "naturally selected" by environments which existed before we were born. We come from the factory with genetic baseline rules of behavior—a "genetic brain legacy"—which influences how we *behave* throughout our lives. Here's a hypothetical example of how behavior could be selected with two separate groups of foxes:

One of these groups carries a gene for "poop-on-the-rocks" and the other group carries a gene for "poop-on-the-grass". Each of these genes is "selfish" in that it only cares about its own reproduction. Moreover, each of these genes controls the pooping habits of the foxes they inhabit. Further suppose rabbits live alongside the foxes.

Those foxes that carry the poop-on-the-grass gene will fertilize the ground and cause the grass to grow. The grass feeds the rabbits; the foxes eat the rabbits, and finally send more selfish, poop-on-the-grass genes into the next generation.

Those foxes that carry the poop-on-the-rocks gene will not fertilize the ground and cause the grass to grow. The grass will not feed the rabbits; the foxes will not eat the rabbits, will starve to death, will not reproduce, and will not send genes into the next generation.

The "poop-on-the-grass" gene is *selected* while the "poop-on-the-rocks" gene goes extinct. This is how behavioral genes, which create the most copies, are passed into the next generation.

Our environment continuously *causes* (as in cause and effect)[4] physical revisions to our genetic legacy. Our immediate behavior is *caused* when new revisions are overlaid upon our genetic legacy, which itself was modified by earlier environmental revisions.

Social Dominance

Genes for social dominance, or "politics[5]," are arguably the most important behavioral adaptations for social animals because genes that are unable to compel another animal to mate will not pass into the next generation—and will become extinct.

Politics is everywhere as we struggle to dominate the world around us! We struggle to dominate the natural world by killing animals, digging, chopping trees and building structures. Parents struggle to dominate their children. Children struggle to dominate their parents. Spouses struggle to dominate each other. Neighbors struggle to dominate other neighbors. Sports teams, economic adversaries and political parties struggle for dominance.

Although few of us are consciously aware of it, we swim in politics like a fish swims in water:

> "In fact, telling primates (human or otherwise) that their reasoning architectures evolved in large part to solve problems of dominance is a little like telling fish that their gills evolved in large part to solve the problem of oxygen intake from water."
>
> —Denise Dellarosa Cummins

Men evolved to compete with other men for resources—especially breeding resources. The most desirable women selected mates who were perceived (genetically and socially) to offer the best opportunities for their children's survival ("sexual selection"). Those men who (like peacocks) were able to display the most social power tended to produce the most children.

Tribal Competition

We are born with different genetic programming for self, family, and social group (or "tribe"). Men evolved to form tribes and cooperate with other men ("reciprocal altruism") in order to obtain more resources than they could as individuals or families. Tribal society provides the rules for competition, but an individual's goal is always based on a genetic drive to pass on the most genes.

Tribes serve each member's fitness by competing with other tribes for resources. Tribes form political alliances and cooperate with other tribes in order to obtain more resources than they could as individual tribes. Tribes that fail to serve the fitness of its individuals become unstable and subject to fundamental change (e.g., revolution).

When tribal leaders "feel" that fitness is better served by violence, they will attack other tribes and take that tribe's resources. The tribes with the most resources and largest populations usually win.

Mr. Hyde and Dr. Jekyll

Deception is common in nature: animals evolved to look like plants, birds pretend injury to lure predators away from nests, and lizards inflate themselves pretending to be more dangerous than they really are, but humans are by far the most accomplished liars in the animal kingdom. Two separate personalities live inside each of us: a "Mr. Hyde" who quietly makes all the decisions and a little voice in our heads I will call "Dr. Jekyll," who makes all the excuses. Mr. Hyde is only interested in sex, money and social power, while Dr. Jekyll is only interested in how Hyde's decisions appear to the neighbors.

Mr. Hyde's decisions are not based on calculation; they are based on subconscious image comparison, and he will select the choice that "feels best." About half a second after Mr. Hyde makes a decision, he invents a socially acceptable excuse for Dr. Jekyll, and then Jekyll tells the neighbors.[6] Unfortunately, Dr. Jekyll has no way of knowing whether Hyde is telling the truth or lying. This makes it impossible for anyone to know for certain what Mr. Hyde is up to.

The Net-Energy Principle

Energy "resources" must produce more energy than they consume, otherwise they are called "sinks."

Net-energy analysis became a public controversy in 1974 when two stories made the news. In the first, *Business Week* reported that Howard Odum had developed a "New Math for Figuring Energy Costs." Among other results, this new math indicated that stripper oil well operations were energy sinks rather than energy sources. According to this analysis, these operations could be profitable only when cheap, regulated oil was used to produce deregulated oil. The other net-energy story of 1974 was a study by Chapman and Mortimer, asserting that a rapidly growing nuclear program would lead to an increased use of oil rather than to the desired substitution[7].

As we know from physics, to accomplish a certain amount of work requires a minimum energy input. For example, lifting 15 kg of rock 5 meters

out of the ground requires 735 joules of energy just to overcome gravity—and the higher the lift, the greater the minimum energy requirements. Internal combustion engines—so-called "heat engines"—also consume a great deal of energy. The efficiency of heat engines is *limited* by thermodynamic laws. Thus, a typical auto, bulldozer, truck, or power plant wastes more than 50 percent of the energy contained in its fuel.

One seldom thinks about the energy that is utilized in systems that supply energy—such as oil-fired power plants. Energy is also utilized when exploring for fuel, building the machinery to mine the fuel, mining the fuel, building and operating the power plants, building power lines to transmit the energy, decommissioning the plants, and so on. The difference between the total energy input (i.e., the energy value of the sought-after energy) minus all of the energy utilized to run an energy supply system equals the "net energy" (in other words, the net amount of energy actually available to society to do useful work).

> **"Energy "resources" must produce more energy than they consume, otherwise they are called "sinks."**

We mine our minerals and fossil fuels from the Earth's crust. The deeper we dig, the greater the minimum energy requirements. Of course, the most concentrated and the most accessible fuels and minerals are mined first; thereafter, more and more energy is required to mine and refine poorer and poorer quality resources. New technologies can, on a short-term basis, decrease energy costs, but neither technology nor "prices" can repeal the laws of thermodynamics:

- The hematite ore of the Mesabi Range in Minnesota contained 60 percent iron. But now it is depleted and society must use lower-quality taconite ore that has an iron content of about 25 percent.[8]
- The average energy content of a pound of coal dug in the US has dropped 14 percent since 1955.[9]
- In the 1950s, oil producers discovered about fifty barrels of oil for every barrel invested in drilling and pumping. Today, the figure is only about five for one. Sometime around 2005, that figure will become one for one. Under that latter scenario, even if the price of oil reaches $500 a barrel, it wouldn't be logical to look for new oil in the US because exploration, drilling, recovery, refining, and distribution would consume more energy resource than it would recover.[10]

Decreasing net energy sets up a positive feedback loop: since oil is used directly or indirectly in everything, as the energy costs of oil increase, the energy costs of everything else increase too—including other forms of energy. For example, oil provides about 50 percent of the fuel used in coal extraction.

Peak Oil: Peak Ancient Sunshine

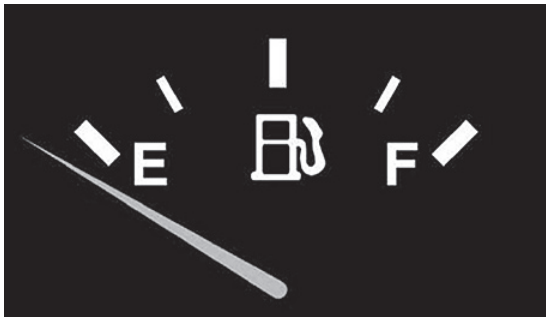
Although economists treat energy resources just like every other resource, energy is in fact the *prerequisite* for every other resource. Energy production is limited by the net-energy principle, and the global economy is physically limited by *available energy*—it always has been and always will be.

Available energy on this planet has been declining ever since humans began digging "ancient sunshine" (fossil fuel) out of the ground. The amount of fossil fuel burned in a single year (1997) totaled 14 thousand billion pounds of carbon, which was generated by 97 million billion pounds of prehistoric NPP[11]. This is more than 400 times all the plant matter that grows in the world in a year, including the vast amounts of microscopic plant life in the oceans![12]

Oil is the most important form of energy we use, making up about 40 percent of the world energy supply (DOE, 1998). No other energy source equals oil's intrinsic qualities of extractability,

transportability, versatility and cost. These are the qualities that enabled oil to take over from coal as the front-line energy source in the industrialized world in the middle of the last century, and these qualities are as relevant today as they were then.

For many years, geologists and petroleum engineers have published estimates of how much oil can be recovered from any given basin. This is known as "estimated ultimately recoverable" (or EUR) oil. Remarkably, estimates of total worldwide EUR oil have varied little over the past half century.



Fifty years ago, geologist M. King Hubbert developed a method for projecting future oil production and predicted that oil production in the lower 48 states would peak about 1970. Hubbert's prediction proved to be remarkably accurate. Yields have risen slightly compared to Hubbert's original estimate, but the timing of the peak and the general downward trend of production were correct. Hubbert showed that oil production peaks and starts to decline when approximately half of the EUR oil has been recovered.

Central Bankers Can Not Print Energy!

No alternative (even nuclear) has the potential to replace more than a tiny fraction[13] of the power[14] presently generated by fossil fuel. Geologists have calculated that global oil production and North American natural gas production are peaking about now. American coal is expected to peak about 2035.[15]

Once global oil production peaks, it will become physically impossible to increase global net-energy production. It's physically impossible for central bankers to increase global economic growth (as measured by physical activity) *because global net energy will fall for many decades into the future!*

Thermodynamic Death Of Democracy

Imagine having a motor scooter with a five-gallon tank, but the nearest gas station is six gallons away. You can not fill your tank with trips to the gas station because you burn more than you can bring back—it's impossible for you to cover your overhead (the size of your bankroll and the price of the gas are irrelevant). You might as well put your scooter up on blocks because you are "out of gas"—forever.

If a country must spend more-than-one unit of energy to produce enough goods and services to buy one unit of energy, it will be impossible to cover the overhead (e.g., Zimbabwe). At that point, every country's economic machine is "out of gas." Money and common stocks become worthless—forever.

Falling Net Energy, Overpopulation, And Collapse

The "collapse" of a country is caused by "too many people competing for too few resources"[16]. When a country can not supply enough resources to satisfy its members, that country becomes unstable and subject to fundamental change.

The human mind serves "fitness"—not "truth." Since every individual is programmed to pursue personal fitness and lie about intentions, no civilization has ever been able to convince its members to cooperate enough to survive the depletion of the energy resources which gave it birth. When confronted with ever-declining resources, the preservation of social order requires more-and-more cooperation, but individuals are genetically programmed to reduce cooperation and seek advantage. This genetic legacy sets up a positive feedback loop: declining common resources cause individuals to reduce cooperation even more, which reduces common resources even faster, which leads to collapse even faster.

Lie, Cheat, Steal, Rape, and Kill

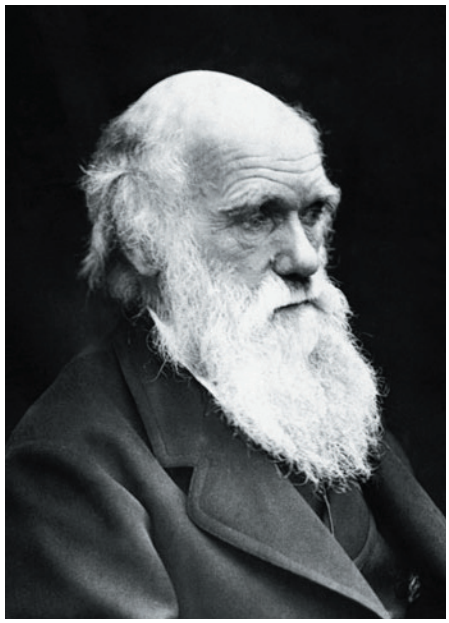
Society only directs our behavior when we perceive that it is able to reward or punish us. A "collapsed" society has no influence over our behavior.

That's why cultures disappear and people revert to more violent ways of life. Our present society began to collapse years ago because of the rising energy costs of energy.[17]

We include others in our society when we *feel* that it increases our fitness to do so, but we invent excuses to kick minorities out of our society when resources are insufficient. Allies can become enemies almost overnight. The collapse of Yugoslavia is an example of neighbor slaughtering neighbor.

The "Thermo/Gene" Collision

> "Man still bears in his bodily frame the indelible stamp of his lowly origin."
> —Charles Darwin, 1871



We have seen that thermodynamic laws promise us less-and-less, while our genes are demanding more-and-more. Although these biophysical laws are now politically incorrect and suppressed from public discourse, *these laws will not go away.* Roughly fifteen years from now, the thermo/gene collision will cause people to revert to a fundamentally different set of behaviors. These are the ancient behaviors that we evolved during the many periods of overpopulation which have occurred in our millions of years as animals. Those in power will use every tool at their disposal—including nuclear weapons—to increase their *fraction* of the remaining energy thereby maintaining social hierarchy (social advantage) for their children.

The "thermo/gene collision" will ultimately kill billions of people worldwide as nuclear wars, starvation, and social system collapse grip the planet into the future. When our subconscious feels our fitness is best served by lying, cheating, stealing, raping, or killing, then we will do so. *It is our genetic legacy.* ■

End Notes

1. Fifteen years, plus or minus ten years, is when I estimate anarchy will reign in the United States. Please note that I do *not* advocate anarchy. Indeed, anarchy is the worst possible future. However, our government was not designed to solve social problems and will be utterly helpless in the face of unfolding biophysical law-driven events.
2. A "metaphor" is a figure of speech in which a phrase denoting one kind of action is used in place of another to suggest a likeness or analogy between them. Richard Dawkins invented the "selfish gene metaphor" which is a fictional view used to illustrate evolution.
3. "Adaptive" means the animal is better able to reproduce its genes in the environment at the time of reproduction.
4. Energy (light, sound, touch, smell) striking our sensors causes physical changes in our brain.
5. "Politics" is used here to mean one compelling another to act in a certain way—in the broadest sense—either by reward or punishment.
6. The half a second delay between decision and conscious awareness was measured in experiments conducted by Dr. Benjamin Libet and others.
7. *Net Energy Analysis,* by Daniel T. Spreng, Oak Ridge Assoc. Univ. & Praeger, 1988.
8. p. 11, *Beyond Oil*, by John Gever et al., Univ. Pr. Colorado, 1991.
9. p. 12, Gever.
10. p. xlv, Gever.
11. NPP: Net product of photosynthesis.
12. "Burning Buried Sunshine: Human Consumption of Ancient Solar Energy," Jeffery S. Dukes, Department of Biology, University of Utah, 25 March 2003, http://globalecology.stanford.edu/DGE/Dukes/Dukes.html#Publications
13. http://warsocialism.com/alternatives.htm
14. "Power" is expressed in "watts" or "horsepower." It's the product of energy "potential" (e.g., volts) multiplied by the "rate" (e.g., amps) of energy extraction from a resource.
15. http://www.fromthewilderness.com/free/ww3/052504_coal_peak.html
16. Here I mean too few resources for whatever reason. In Joseph Tainter's example, resources were restricted partially because of social system complexity http://www.dieoff.com/page134.htm
But the actual cause of collapse was our brain's "genetic legacy" within that complex, energy restricted environment.
17. In 1970's, we had enough resources for *both* the war in Vietnam and President Johnson's Great Society.