

ECOLOGICAL ECONOMICS

Economics, Ecology, Technology & Ideology

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Introduction

This lecture is about the lenses through which we see the economics of the environment and natural resources. I begin with literal definitions of the four titled terms and then expand them into their contemporary context. I conclude by integrating them into what I call Ecological Economics.

Literal Definitions

Economics derives from the Greek meaning ‘management of the household’; Ecology from the Greek meaning ‘life in and around the household’; Technology from the Greek meaning ‘reasoned art’, and, Ideology from the Greek via the French meaning ‘the science of ideas’.

Economics

Economics as management of the household raises the question: What is the relevant household? In its original sense it was the self-sufficient or autarkic rural estate. Management, however, ascended to higher orders as the self-sufficient village, town, city and most recently the Nation-State. A global society in which there is contiguous urban development separated only by natural barriers – mountains, oceans and deserts - has been called the *Ecumenopolis* – the World City - by urban planner [Constantinus Doxiadis](#); its global reality is visible in a composite photograph of “[The World at Night](#)” published by NASA in the year 2000. If seeing is believing then it provides visual evidence of humanity enframing its home planet. We see a World City whose shimmering lights soar out into the infinite blackness of space. However, there is no global economics, no generally accepted model for managing the planet.

As a modern discipline of thought Economics began with the French Physiocrats portraying the Nation as a giant estate in which the surplus required for growth and development came from agriculture – one planted seed yields 1000, that is productivity. The Physiocrats, however, lost their heads to Madame Guillotine during the French Revolution and the locus of Economics shifted to England, to Adam Smith and to the surplus generated by the division and specialization of labour in manufacturing. And the paradigm shifted from biology to mechanics. While Smith and the Classical School were concerned with ‘The Wealth of Nations’ management of the national household was left to the market. There was no macro-economics. I will return to this question under Ideology.

This shift to mechanics was formalized in the 1870s with the Marginalist Revolution giving birth to what I call the Standard Model of Economics

characterized by its iconic 'X' marking the spot called [market equilibrium](#). It is a truly elegant model satisfying [Descartes'](#) requirement of a science in that it uses deductive logic based on a set of key assumptions whose conclusions are subject to geometric and mathematical proof. In effect it atomizes the Economy into the individual consumer and firm. The resulting paradigm led [Thomas Kuhn](#) to single out Economics among all the social sciences as best approximating 'normal science'. But to paraphrase economist [Herbert Simon](#), Economics is a science of the artificial ruled by human not natural law.

The downward sloping arm is Demand generated by the budget constrained maximization of satisfaction by consumers: the lower the price the higher the consumption. The upward sloping arm is Supply generated by the cost constrained maximization of production by firms: the higher the price the greater the supply. 'X' marks the spot where Supply equals Demand. At a price above this point Supply exceeds Demand forcing firms to lower their price until equilibrium is attained; at a price below this spot Demand exceeds Supply forcing consumers to bid up the price until equilibrium is attained.

The model is mechanistic marrying Newton's calculus of motion and Bentham's felicitous calculus of human happiness as in 'life, liberty and the pursuit of happiness'. It is, however, limited in a number of ways. For example it assumes all benefits are captured by consumers and all costs are paid by producers, *i.e.*, all costs and benefits are internalized in final market price. If, however, there are costs or benefits external to market price then we have 'market failure'. Classic examples include the costs of pollution and the benefits of mass education.

In the late 1880s, however, long before externalities were formally recognized by mainstream Economics, the limitations of this mechanistic manufacturing model was recognized with the emergence of Agricultural Economics. The vagaries of the weather do not lend themselves to mechanistic modelling – just ask the water-logged Saskatchewan farmer of today. Similarly human laws governing property ownership and other institutional arrangements do not yield to such modelling. Thus the Riel Rebellion of 1885 in Saskatchewan was arguably a clash between riparian rights (access to water) in the French tradition in which each farmer is guaranteed access versus English Common Law in which there is no such guarantee. More recently in the knowledge-based economy there is no 'U' shaped average cost curve found in manufacturing but rather an 'L' shaped curve. Thus the first unit of Windows 7 may have cost \$250 million but the second, third, fourth and all subsequent units cost 99 cents with access to a DVD burner. This is one reason for State imposed intellectual property rights like copyrights and patents.

Most limiting, however, is the inability of the Standard Model to establish a determinant profit maximizing solution for price and output under oligopoly – the

dominant form of modern market competition. Oligopoly is characterized by a small number of large firms that dominate the industry; a competitive fringe of smaller firms; and, the actions of any major producer being immediately perceptible to rivals, *i.e.*, there is interdependency among sellers whereby the actions of one results in a reaction by the others.

There are many alternative theories and some claim there is no determinant solution. A very complex one is the ‘Nash-Cournot’ equilibrium proposed by [John Forbes Nash](#), protagonist of the movie ‘A Beautiful Mind’. As an aside the solution may have contributed to his subsequent madness. It involves extremely complicated mathematics and a series of critical assumptions. In fact, the dance of the oligopolists has generated a distinct sub-field of Economics called ‘Game Theory’. So much for managing the household!

Ecology

With Ecology defined as the study of ‘life in and around the household’ we leave mechanics for biology. The world according to theoretical biology is composed three spheres: (i) the geosphere, the world of physics and mechanics; (ii) the biosphere, the world of biology or life; and, (iii) the noösphere, the world of human thought. To Aristotle, there were four causes: material, efficient, formal and final. In this regard it is important to recall that [Aristotle](#) was a biologist, not a physicist. Arguably, the geosphere is governed by material and efficient causes, *i.e.*, when-then or billiard-ball causality. In the biosphere, however, formal and final causes or ‘causality by purpose’ is at work while in the noösphere of human thought arguably all four are at play.

There were three aspects of living things that demonstrated to the philosopher [Immanuel Kant](#) that teleological or final causes were involved. I call these: ecology, metabolism and ontogeny. First, he could see that the web of mutually supportive relationships between various species of plants and animals constituting an ecological community was so complex that linear ‘when-then’ causality was simply insufficient to explain its existence. Second, in the metabolism of living things each part is reciprocally means and end to each other. This involves a mutual dependence and simultaneity that is difficult to reconcile with ordinary causality. Third, in ontogeny, or development of the individual, the future mature end-state guides successive stages of development. This is a clear case of formal and final cause.

Following [Marjorie Grene](#), mother of the modern philosophy of biology, every organism lives in an active environment consisting of: (i) invariants, *e.g.*, the river, the ocean, the sky, the mountains, the seasons, *etc.*, and, (ii) affordances presented by predator, prey, possible mates and/or symbionts. Environmental invariants become subsidiary or ‘tacit’ to focal awareness of affordances. In this

view, 'knowledge' is orientation in an environment resulting from tacit integration of subsidiary and focal awareness into a gestalt whole called 'knowing'. While Darwin identified 'survival of the fittest' modern biology has identified coevolution as a dominant force at play. Thus the humming bird's bill evolved to perfectly match the orchid's blossom.

And Ecology involves not just the web of mutually supportive relationships in a rain forest or the Arctic. It involves you and I. To drive the point home but to avoid the digestive example of 'Montezuma's revenge' I ask those wearing short sleeves to take their thumb and touch the inside of their elbow. There you will find some 182 species of microbes. In fact a whole new science is emerging: the human microbiome involving the study of all the microbes that live in and on people. Given that human beings depend on their microbiome for essential functions including digestion, a person is really a superorganism consisting of one's own cells and those of all associated symbiotic bacteria. In fact, bacterial cells outnumber human cells by 10 to 1, meaning a person is, in a sense, a minority in one's own body.

Finally with respect to Ecology consider [Stuart Kaufman's assessment of comparative advantage and the benefits of trade](#) in Economics:

The advantages of trade predate the human economy by essentially the entire history of life on this planet. Advantages of trade are found in the metabolic exchange of legume root nodule and fungi, sugar for fixed nitrogen carried in amino acids. Advantages of trade were found among the mixed microbial and algal communities along the littoral of the earth's oceans four billion years ago. The trading of the econosphere is an outgrowth of the trading of the biosphere.

Technology

The word 'technology' derives from the Greek *techne* meaning Art and *logos* meaning Reason, *i.e.*, reasoned art. In its modern sense the term was introduced in 1859 by Sir Richard Francis Burton, Victorian explorer and translator of the *Kama Sutra*, the *Arabian Nights* and the *Perfumed Garden*. *Techne*, however, dates back to the ancient Greeks for whom it signified all the Mechanical Arts except medicine and music. As such, it was suitable only for the lower classes not for the upper class which practiced the Liberal Arts of 'free' men. It was thus in ancient Greece that the English aphorism 'gentlemen don't work with their hands' had its beginning.

Before 1859 there was art, craft and mechanics; afterwards, technology. While early attempts were made to formulate philosophies of mechanics, they remain footnotes in history including Ernst Kapp who in 1877 coined the term '[philosophy of technology](#)'. It was, however, Karl Marx who ten years earlier

produced the first true [philosophy of technology](#) with his *Das Kapital* combining ‘the means of production’ with a critique of a rapidly industrializing society.

Martin Heidegger, however, is in fact the father of the post-Marxist or modern philosophy of technology (1954). Humanity enframes and enables Nature to serve human purpose. This is not just a technological imperative, it is also a biological one. Organisms do not simply adapt to the environment. Many actively adapt and modify it to satisfy their needs, *e.g.*, the ant, bee and beaver. This involves constructing new environmental invariants, *e.g.*, colonies, hives or lodges.

Of all organisms on Earth, humanity has had the greatest success in restructuring its environment. Tools, specifically the [tooled knowledge](#) they contain, are the means by which we animate and re-organize Nature. In effect, Technology constructs a distinct human ecology growing ever more distant from Nature as our knowledge grows. Consider coming home from the office in a car, unlocking the door to the house, turning on the lights, microwaving supper, watching television, checking one’s email then driving to the local mall to shop. All is technology. It enframes and enables Nature patterning life in the human ecology.

According to the philosopher of science [Michael Polanyi](#) the ultimate in tacit knowledge is the human body. Everything we do in, and know of the world is through our bodies – seeing, hearing, touching, tasting, smelling. The body, however, is normally transparent to the mind in its doing and knowing. This transparency Polanyi calls “indwelling”.

Indwelling has a powerful corollary. For example, using a hand tool such as a hammer: “the impact that their handle makes on our hands and fingers is not felt in itself at the place where it happens, but as an impact of our instrument where it hits its object”. We thus ‘indwell’ in our technology, in our tools and instruments. The hammer, the telescope, the synchrotron become extensions of ourselves. Polanyi concluded that indwelling “bridges the gap between the I-It and the I-Thou, by rooting them both in the subject’s I-Me awareness of his own body, which represents the highest degree of indwelling”.

Ideology

The word ‘ideology’ has many meanings today but was coined simply enough by [Condillac](#), a contemporary of Adam Smith, to mean ‘the science of ideas’. Separation of Church and State was critical to both American and French Republican Revolutions. Creation of a secular ‘science of ideas’ to counter the awe and mystery of religious and metaphysical thought and ritual was part of a revolutionary agenda designed to overthrow an Ancient Regime of subordination by birth. In short an Ideology explains how the world works without a god; with a god it becomes theology. And in this regard the word ‘theory’ literally means a god’s eye view.

It is important to note, however, that Ideology involves ‘the sciences of the artificial’, the so-called human sciences which are subject to human, not natural laws. The natural, experimental, instrumental sciences are different. They are subject to the laws of Nature and rather than generating certainty or belief generate doubt. In fact Descartes’ famous dictum ‘I think, therefore I am’ could more accurately be restated as ‘I doubt, therefore I am’. By contrast, a contemporary definition of Ideology is: A systematic scheme of ideas, usu. relating to politics or society... and maintained regardless of the course of events” (OED, 4).

If Technology *cum* Heidegger enframes and enables Nature to serve human purpose then Ideology enframes and enables our ideas, our thoughts. An Ideology becomes subsidiary to our focal consciousness, it becomes an environment invariant for the affordances of our thoughts. It becomes background to the figure of our ideas.

With the collapse of Communism there is arguably only one Ideology still standing - Market Economics in which everything has a price – kidneys, children, the environment, everything. It is, however, arguably split into two antagonistic schools of thought. One, the Austrian School of the ‘vons’ - von Mises & [von Hayek](#), believes in the supremacy of the market with limited if any government and no public intervention. The other, the [Keynesian School](#), believes in a regulated marketplace and public intervention to correct externalities to market price. This is called macro-economics. Both are ideologies, not natural science.

Conclusion

The natural sciences tell us that we are an animal species. As such we naturally engage in enframing and enabling Nature to serve human purpose. We call this Technology. But Nature is ecological – it is a complex web of mutually supportive relationships between bacteria, plants, animals and ourselves. The unprecedented evolutionary ascent of our species to global dominion in some twenty-five generations arguably resulted from institutionalization of a new way of knowing - the experimental method, or, as originally called ‘experimental philosophy’. This, however, requires controlled experimental conditions – hold all factors constant then measure the effect of a change in one, then repeat the experiment to confirm the results. With respect to Planet Earth we are arguably engaged in an uncontrolled experiment, one for which replicability of results is simply not possible.

There is an old adage: Knowledge will set you free but first it will hurt you! With the Cambrian Explosion of knowledge following the initial Scientific Revolution, this adage arguably applies to all knowledge domains. We need to manage our global household. To do so we need an Ecological Economics but we also need the humility to acknowledge our ignorance – our want of knowledge –

about this most complex of all systems. We need an Ecological Economics that mitigates and balances crude cost-benefit analysis and overzealous application of the precautionary principle. What we don't need is another pair of dirty hands * resulting from sins of our commission or of omission!

** A Postscript on Dirty Hands*

The perceived misuse of 'new' knowledge is known as 'the problem of dirty hands'. Originally coined to describe physicists spawning the atomic bomb, there are lots of dirty hands to go around. Biology gave birth to eugenics and its demon child, the Holocaust with the smiling, all-knowing biologist greeting the condemned at the gates of Auschwitz.

Economics too must accept paternity for its own devil spawn, the Market/Marx Wars, which, for half a century, threatened mutually assured nuclear destruction of the human race because of an ideological dispute over private property. Even the Arts must accept responsibility. In Nazi Germany, all modern means of artistic expression - from literature, music, painting and sculpture to radio, television and the motion picture - were harnessed in the service of a cause so evil that colour film of the Nuremberg Rallies has never been released to the public by the American Government. What in scratchy black and white is ancient history is to the modern eye a symbol of the power of Art to serve evil in living colour. Then there is the 'Agitprop' practiced by Lenin's Commissar of Enlightenment consolidating the revolution before Stalin took over and displaced it with socialist realism and the gulag. Art is no more *summum bonum* - all good - than physics, biology or economics.