# Order from Chaos and the 'Economy-Ecology Analogy'

## A re-reading of 'Postmodern Science'

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### Abstract

There are scientists around who believe they have discovered God. Scientists like Fritjof Capra and Paul Davies are two notable examples of those scientists who see the presence of divine processes in both Nature and Humanity. Yet the God they have discovered does not look like a pale ghostly white-bearded old man as depicted in so many films and paintings. Instead, according to these scientists of God, God's Earthly image is actually remarkably similar to the colorful fractal swirls inspired by chaos theory, and, also, at times, God seems to look a lot like the orderly chaos that is inherent within the world's stockmarkets.

For numerous scientists like Davies and Capra, who adhere to what are called the 'New Sciences' of chaos theory and complexity theory, there is an avowed goal to identify the existence of ultimate meanings and universal processes that run through all phenomena of the entire Cosmos. These meanings and processes are sometimes thought of as scientific conceptions of God. Scholars fond of the New Sciences are also fond of labeling their particular scientific approach as Postmodern since they are convinced that their science is a science that comes after, and goes beyond, Modern science. By rejecting the philosophical baggage of Modern science (such as mechanicism, reductionism, atomism and dualism) in favor of 'new' postmodern principles of organicism, holism, and self-complexification, Postmodern Scientists believe they are instigating a paradigm shift towards an ecologically and socially benevolent worldview.

However, according to the research I have conducted at the IAS-STS in Graz, such may not be the case. Postmodern Science is a beast incurably infected with mechanicism and probably many other Modernist diseases. It is also the case that there a numerous parasitic idealogues just waiting to pounce on the metaphysical meanderings of Postmodern Science in an effort to claim it as their own and use it as a finalized legitimating schema of the post-communist world.

## Introduction

*Modernism:* in the 1990s environmentalists discovered it and they did not like it. In the eyes of contemporary environmental thinkers and philosophers of nature such as Fritjof Capra, Charles Birch, Frederick Ferre, Carolyn Merchant, Aaron Gare, Donald Griffin, Charlene Spretnak and many others, Modernism is the Worldview of Newton and Descartes. Because of its adherence to Newtonianism and Cartesianism, Modernist science is said to be suffering from mechanicism, reductionism, atomism and dualism. When this philosophical framework is manifested through modern day scientific exploration, and through modern day scientific management of nature and society, it is believed that environmental catastrophe will ensue. Mechanicism leads to a dead Earth, reductionism leads to a neglect of the larger wholes, atomism creates artificial divisions between interrelated entities, and dualism separates humans from other living things[1].

*Postmodernism:* this environmentalists also discovered recently but, in this case, they liked it. Having observed, in a cursory way, Postmodern art, having observed Postmodern literature, having observed Postmodern architecture and all manner of other Postmodernisms, the previously named environmental thinkers and philosophers of nature call for the development of a 'Postmodern Science'; a science that replaces the mechanic with the organic, that swaps atomism and dualism with unity, and chooses holism over reductionism. This done, it is said, a living, morally-considerable

1 No doubt it will be thought by some readers that Modernism is more than just a critique of these four elements of Cartesian and Newtonian philosophy. Certainly, when reviewed by most scholars Modernism usually found as a current flowing through a whole spectrum of events and ideas in the history of society and culture since the 17th century. It is not me that reduces Modernism to Modernist science, and thence the scientific principles of reductionism, mechanicism, atomism and dualism. This warning obviously alludes to the distance that exists between Postmodern Science and Postmodernism, in general, despite the closeness of their names.

Earth will be recognized, whose inherent purposive oneness and whose environmental complexity will be observed and respected in all its interrelated intricacy.

For followers of Postmodern Science, let's call them 'Postmodern Scientists', there is within contemporary science, what they call an emerging paradigm shift. This paradigm shift has been much applauded in the past ten years or so and has often been expressed in revolutionary terms. For instance, Arthur J. Fabel states "the current ferment in science is potential for more than a Copernican revolution" (Fabel, 1994:304), while Aaron Gare (1995) commented that the period of scientific development we are now in is a period similar to the birth of classical science in ancient Greece or its renaissance in 17th Century Europe. Fritjof Capra has echoed this excitement in his 1996 book *The Web of Life:*

> The new understanding of life may be seen as the scientific forefront of the change of paradigms from a mechanistic to an ecological Worldview. (Capra, 1996:6)

The new Worldview, about which Fabel, Gare and Capra speak, possesses different labels. Paul Davies refers to it as the paradigm of the 'New Sciences', whilst Capra, himself, labels it both 'dynamical systems theory' and 'Deep Ecology'. Meanwhile Carolyn Merchant, Charles Birch, Donald Griffin, Aaron Gare and many others describe it as Postmodern Science[2].

So what is this new paradigm? To summarize it, here is a synthesized paraphrasing of the definitions of the new paradigm by the writers named above: the emerging paradigm consists of an 'evolutionary dynamical systems view of the cosmos that elevates processes

2 The following works are but a small sample of the ongoing elaboration of Postmodern Science under various names: Cobb (1988), Davies (1983), Davies (1987), Fabel (1994), Ferre (1989), Ferre (1993), Ferre (1996), Gare (1995), Griffin, ed., (1988), Hayles, ed., (1991), Jagtenberg and McKie (1997), Krippner (1991), Kuppers, B-O. (1990), Merchant, C., ed., (1994), Moore (1992), Roszak (1979), Roszak (1991), Scott, G. (1991).

over substances and is most manifest in the idea that self-organizing complexity emerges from chaos'. Thus, chaos theory, complexity theory and Gaia theory are core examples of the new paradigm.

## Gaia and the mechanicism – organicism divide

We can introduce an investigation of Postmodern Science with what Merchant (1994) has made out to be one of the core theories of Postmodern Science; the Gaia theory. Such an introduction helps to contextualize the stories that Postmodern Science purports to tell.

Gaia theory, to many narrators of contemporary philosophy of nature, is an environmentally friendly scientific theory which posits that the Earth is alive. James Lovelock, the inventor/discoverer of Gaia, both confirms and denies this reading of Gaia theory. At times he waxes philosophical about the important social and environmental implications that his living Earth concept might produce (see Lovelock, 1991). At other times he steadfastly disavows that Gaia is living; it is merely a metaphor that pops up necessarily when describing the biotic and abiotic systems that he believes operate at the global scale (see Lovelock, 1988).

Paul Davies, one of the keenest and most prominent exponents of the ideas of Postmodern Science, is fond of the Gaia theory and describes it thus:

> Gaia provides a nice illustration of how a highly complex feedback system can display stable modes of activity in the face of drastic external perturbations. (Davies, 1987:132)

James Lovelock, himself, defines Gaia as a global systems theory which declares that the various living constituents of the Earth work unconsciously together via a series of feedback controls to produce a physical environment suitable for life.

Lovelock is not an ecologist. He is not even a biologist. His stated occupation is often given as 'atmospheric chemist', but perhaps the title 'chemical engineer' might be a better one. Although he claims affinity with things organic and living, Lovelock's roots lie with machines. He is the inventor of numerous scientific machines and has earned much of his income from their patenting. Like many others who happily combine biology with machines Lovelock has an intense interest in the scientific field known as cybernetics. He is not ashamed of this at all and happily extols the virtues of Gaia theory as emerging from his interest in the feedback control theory of cybernetics. Cybernetics and feedback control theory are fields and subjects of study which emerged out of the World War II military science that tried to perfect the feedback response of military hardware such as anti-aircraft guns and radar[3].

Lovelock has been so infatuated with machines that he consistently compares the self-regulating systems of the global environment to the cybernetic ability of various machines, from ovens and fridges to air-conditioning units. He does this for various reasons; sometimes just to describe the principles at work in feedback control; sometimes to explain how a fridge or an oven does not need to be conscious of what it is doing to be self-regulating.

When he was asked to do work for NASA (the United States National Aeronautics and Space Administration) it was in his capacity as a mechanical expert. Lovelock was commissioned for NASA's Viking Project in the late 1960s to contribute to the designing of instruments that could detect life on Mars. Lovelock, however, was not content to explore the life on Mars issue just as a problem in mechanical detection and before long he decided to apply his cybernetic worldview on a planetary scale to address the

3 For explorations into the history of cybernetics see: Capra, F. (1996), Heims (1991), Laszlo (1972).

biotic potential of the Red Planet. There is no life on Mars, Lovelock declared in 1971, because the sky there is not blue like the Earth's. No blue sky, no oxygen producing entities: no life, his argument goes (see Lovelock, 1988, or Lovelock, 1991).

Lovelock was, by no means, the first cyberneticist to hypothesize about feedback in living systems. The acknowledged founders of cybernetics, people like Norbert Wiener, John von Neumann and Ludwig Bertallanfy, were all interested in applying cybernetic explanations derived from studying machines to phenomena within the biological world. Modern day systems theorists have carried on this tradition, extending systems science to biochemistry, cell biology, ecology and population studies. The systems biology so beloved of advocates of the New Sciences and fans of Postmodern Science was thus a child of mechanistic views. When looking at cybernetics and all its grandchildren like Gaia, Chaos theory and Complexity theory, mechanicism and organicism cannot be de-coupled. Thoughts of ejecting mechanicism from modern day ecological science by adopting Gaia theory as a framework are sheer fantasy since Gaia theory is so completely inscribed with mechanicism.

Cybernetics and systems science do not just represent the welding and melding of organic and mechanical thought. The idea of feedback, which is a foundational principle of systems science, deserves an intellectual expedition in itself. One of the starting points for such an expedition lies in the claim by Paul Davies that the new paradigm envisages a much freer universe than does the old Newtonian paradigm (see Davies, 1990). For instance, just as Gaia brings life to the world, so the chaos in Chaos Theory, another core theoretical node of the new paradigm, supposedly frees the constituents of the universe from being trapped in the prison of Newtonian determinism. Under the metaphysical schema of the New Sciences we now exist in a living

universe that has potential to evolve. The modernist idea that the universe is a predesigned clockwork mechanism, slowly grinding towards thermodynamic decay is supposedly weakening within both science and society (suggests Paul Davies in Davies, 1987). In its stead we have an organic model of the universe, a universe that evolves towards greater and greater complexity and a universe whose constituents are not predetermined in their behavior.

## Cosmic order and freedom

According to Paul Davies, this emerging paradigm – of evolution instead of decay and indeterminacy instead of determinacy – is an answer to an age-old problem of reconciling order and freedom. It is, to Davies and other New Scientists, a way that the universe can be thought of as exhibiting both order and freedom, since the various constituents of the universe are free from the pre-determined actions or a central designer but the actions they do undertake nevertheless contribute to an overall order.

This idea of freeing the universe is a source of inspiration for many proponents of the New Sciences and for many Postmodern Scientists. One might suspect, however, that the constituents of the universe are hardly free if they have to obey general laws of ever-increasing cosmic complexity or if they have to contribute to the overall general order of the universe. Moreover, empiricists would point out that there is just as much retro-evolution towards less complexity as there is the opposite.

Now, Davies' attempts to free the universe are not new. Nor is his self-declared aim to reconcile order, chaos and freedom. In the 17th and 18th centuries, right smack bang in the middle of the ascent of Modernism, Samuel Clarke, David Hume and others attempted the same thing. According to historian Otto Mayr,

they found their inspiration in machines.

Mayr charts the development of a Liberal worldview of order and freedom in the late 18th century England with the parallel development of self-correcting machines and their contemporary philosophical evaluation. The most well-established self-correcting machine at this time was, of course, the steam engine. Here was a device that could govern itself, adjust to internal and external variations and make the appropriate corrections without the need of intervention. At this time the steam engine was hardly presented by Watt or any of its other inventors as a masterly example of self-regulation and the inherent compatibility of order and freedom. But for those with a philosophical bent it was an inspiring tangible example of the operation of regulation without external control. Here again the roots of feedback control, that process so essential to systems thought, shows a mechanistic – not organic – intellectual heritage.

Mayr goes on to describe Adam Smith's famous 'Invisible Hand' as the apex of the philosophical tussles about order and freedom. This, he makes out, can thereby be regarded as the solidification of the Liberal worldview. Mayr states:

> The Grand Conclusion of the interdependent, almost symbiotic evolution of the concepts of self-regulation and the liberal system of economics was reached in Adam Smith's classic book 'The Wealth of Nations'. (Mayr, 1986:172)

According to Mayr, Adam Smith's analysis of feedback control in the economy is presented in language so clear and is conceptualized so generally that it can be translated into notation of modern systems theory without any need for additional modification. Adam Smith's philosophical musings about political economics were not merely intellectual tools for specific use in economics, however. His notion of self-regulating and self-organizing order emerging from unconscious and chaotic actions was a full-blown

Worldview. Adam Smith, like Paul Davies and Fritjof Capra today, applied his Worldview broadly; to economics, demographics, social theory, justice theory and the social differentiation of labor.

Given this history, it is interesting to contemplate that the very machine that many environmental historians believe ushered in the industrial age – and all its concomitant environmental ills – was a progenitor of the physical principles that Postmodern Scientists believe will usher in a new environmentally friendly society. It also seems strange to consider the philosophical worldview of liberalism and classical economics to be some sort of forebear of a Postmodern worldview given that Postmodernists themselves would, more often than not, classify both liberalism and classical economics as core components of Modernism. The depth of this irony deserves suspicion of course. It seems just as good a story to classify self-organization, feedback control, the steam engine and cybernetics as being a part of Modernism, and to say that dynamic systems theory and Constructive Postmodern Science are just its latest guise.

If you are not convinced of the 18th century mechanistic and Liberal Capitalist roots of what is called the emerging Postmodern paradigm it may be because you are not convinced of Mayr's stated historical and philosophical links between self-regulating machines, classical economics and modern day systems theory. Yet, using the criteria put forward by Postmodern Scientists as to what constitutes a Postmodern Worldview it becomes clear that Constructive Postmodern Science works to legitimize Modernist aims (and therefore, probably, for environmental and social malevolency rather than against it).

## The ecosystem and the economy: are they birds of a feather?

As indicated above, Constructive Postmodern Scientists have given much effort to describing their emerging Postmodern Worldview. Inherent in this new Worldview is an emphasis on the order from chaos idea inherent in Chaos theory. We should not be afraid of chaos anymore, they say, because out of chaos develops order.

As well as being an essential process in a myriad of natural phenomena, from cell biology to galactic astronomy, this universal principle, order from chaos, is also observable in that bastion of ecological and environmental reality; the ecosystem. The ecosystem, for many environmentalists, is the very unit of environmental wellbeing and the spatio-temporal entity that needs to be focussed upon in all environmental affairs. From this perspective, which is very strong within environmentalism, it is hardly appropriate for atomistic science – which concentrates only on the behavior of isolated individuals – to contribute to ecological management. Only a holistic approach, that integrates the various systems of a natural community, can hope to solve ecological and environmental problems.

So, what is an 'ecosystem' exactly, you may ask? According to popular scientific definitions, an ecosystem is that unit of biology consisting of the biotic and abiotic elements of a particular area whose parts are interacting in a state of energetic and biogeochemical unity to form a stable system. According to those who champion the emerging Constructive Postmodern Worldview the ecosystem is yet another example of a self-organizing order that emerges out of the jumbled chaos of its parts. Davies and Capra, for instance, adhere to this view (see Davies, 1987 and Capra, 1996).

Though the concept was invented by the British ecologist

Arthur Tansley in the 1930s, the ecosystem grew into common usage during the 1950s and 60s through the work of the Odum brothers, two American scientists with a penchant for systems theory. Like the Constructive Postmodernist of today the ecosystem was observed by the Odums as possessing properties palpably analogous to economies. When discussing the ecosystem in his textbook on systems ecology, Howard Odum was so convinced of their parallel natures that he compared individual ecosystems to the economies of single nations (see Odum, 1971). To Odum, the energy being caught and transferred in the ecosystem by autotrophs (plants) and heterotrophs (animals) was like money flowing through the economy from producers to consumers and back again.

This close parallel between the processes that operate in both ecosystems and economies is also much appreciated by current day advocates of the New Sciences. Some of them, however, give it an extra twist. It is not that just any old economy is analogous to just any old ecosystem, it is that fully matured and self-regulating ecosystems show the same properties of organization, process and complexification as capitalist free-market economies. For instance, in his book about self-organization and complexity, Robert Ayres says:

> There is no question that the operation of a money-based, free competitive market generates a kind of coherence, or long range order, somewhat analogous to so-called cooperative phenomena. (Ayres, 1994:134)

He goes on to conclude that the Modernist foe of capitalism is not of this type of self-regulating and self-organizing complexity since socialism requires administration by intervention and planning by an overlooking orderer.

The reversible metaphor between the ecosystem and Free Market economies is brought to a new emphasis by Michael Rothschild in his book titled *Bionomics: The Inevitability of*

*Capitalism*. Rothschild believes he shows all life is a:

> self-organizing phenomenon. From the interplay of hormones in the body to the expansions and contractions of great Arctic caribou herds, nature's intricately linked feedback loops automatically maintain a delicate, robust balance. Markets perform the same function in the economy. Without central planning, buyers and sellers constantly adjust to changing prices for commodities, capital and labor. A flexible economic order emerges spontaneously from the chaos of the free market. (Rothschild, 1990:xiv)

Rothschild then goes on to declare that because economies are like ecosystems if allowed to run free, then planning in economies will only ever lead to collapse of the system concerned. Rothschild's book is an exercise in the naturalization of capitalism, and he admits as much, stating that he

> regards capitalism as an inevitable, natural state of human economic affairs. Being for or against a natural phenomenon is a waste of time and mental energy. (Rothschild, 1990:xi)

Of course, Constructive Postmodernists would probably like to disown anything that Rothschild may have to say but he is merely deriving his philosophies from the same place that they are, the metaphysics of order and freedom as interpreted through the New Sciences and mixed with a few key popular ecological concepts.

Though Postmodern Scientists like Fritjof Capra often rely on the ideas of the New Sciences to bolster the scientific credibility of their new ecological and socially-friendly Worldview, it seems as though one of loudest spokesmen for the New Sciences tacitly shares Rothschild's commitment to the metaphysics of capitalism since we find that Paul Davies wrote in an article for *21st Century* magazine that the model of the world's economy as a ship captained by steersmen should be dropped for a model of the economy as a self-organizing and self-regulating ecosystem (Davies, 1994).

Postmodern Scientists may be quite willing to press ahead with their elaboration of Postmodern Worldview even if they did know that it was being used by people like Rothschild and Davies to justify neo-liberal capitalist economics since it is still a Worldview which is, in other ways, beneficial for the world. Yet, enter Frederick Hayek. Frederick Hayek is not a nobody but one of the foremost champions of Twentieth Century capitalism that there ever was. Hayek always embraced the order from chaos philosophy and often set about to detail some of its workings. Spontaneous orders, as he called them, are the results of the actions of individual entities but not of conscious planning by these entities.

Humans act, so thought Hayek, individually and rationally upon de-centralized information flows, most notably price levels, to contribute to a spontaneous economic order. If Hayek saw the emergence of order from chaos as a universal phenomenon in nature and society then might there not be a link between this viewpoint of his and his celebration of capitalism? According to one of his intellectual historians, Robert Kley, there may be such a link (see Kley, 1992). We can then develop Kley's ideas to show how Hayek's work is, at the metaphysical level at least, intellectually attached to the New Sciences and self-organization theory.

Hayek, like many others, cast his philosophy of self-organization rather widely. Where Adam Smith saw order from chaos in economics and social theory, where Von Neumann saw it in machines and cell biology, where Davies and Capra today see it in ecosystems and solar systems, Hayek also saw spontaneous order in a myriad of places; from crystals to organisms to animal societies and galaxies. However, his favorite place to observe the machinations of self-ordering complexity was, of course, the Free Market:

> Spontaneous social orders are 'the result of human actions but not of human design', the unintended consequence of the independent decisions and actions of many individuals. (Kley, 1992:102) [4]

Although he used his own language and terminology when explicating the formation of spontaneous orders, Hayek did see that the processes he had identified were compatible to those invented by the cyberneticists and their developing self-organization ideas. As Kley indicates, for Hayek, models of order from chaos in economic situations could be explained in terms of information flow, feedback mechanisms and self-generation. Writing in the 1970s – a time that is often interpreted as the historical cusp between the systems theory of cybernetics and the complex systems theory of the New Sciences – Hayek became interested in complexity and organization. He wrote:

> With spontaneous orders their unplanned emergence must arouse some curiosity and warrants the establishment of a distinct body of theory. (Hayek quoted in Kley, 1992:38)

This distinct body of theory would no doubt be claimed as being the preserve and pursuit of the New Sciences by *its* scholars. Where Hayek in the 1970s looked forward to a 'theory of complex phenomena', Davies announced in the 1980s that:

> There exists something like a law of complexity. But the study of complexity is still very much in its infancy. The hope is that by studying complex systems in many different disciplines, new universal principles will be discovered that might cast light on the way that complexity grows with time. (Davies, 1987:21)

Therefore it is probably safe to conclude that Hayek would have approved of the emerging disciplines of self-organization theory

4 As Kley explains, although Frederick Hayek saw spontaneous orders in all sorts of places, his favorite subject of examination was the economy. Order from chaos in this realm meant the economic equilibrium and economic progress emerged from the actions of chaotic individuals as they played and acted in the Market Place, haphazardly buying and selling to push and pull supply and demand.

and complexity theory that New Scientists have become so very fond of.

Following Kley's work on Hayek it is also possible to see the parallel between Hayek's excitement in his discovery of complexity with the current excitement exhibited by New Scientists over their discovery of the same phenomena. Hayek wanted to supersede the simple causal physics of Newton with a more complex science. Something that Davies, and also Capra, talk about a lot. Kley summarizes these ideas of Hayek by saying:

> To bring out the features of complex phenomena Hayek contrasts them with 'simple phenomena'. The number of elements constituting the order of simple phenomenon is small. The orderly structure of its elements is the effect of a few one-way causal relations, and these relations are captured by the basic laws of physics. Finally, its environment does not influence the formation of a simple order. A complex order on the other hand, consists of a large number of elements and is the result of manifold exchange processes among the elements and between them and their surroundings. (Kley, 1992:41)

Without knowing it, Hayek, in expressing the above ideas, could have been setting up the program of research that has now become complexity theory.

One well-known modern-day ecologist (who would call himself not a systems ecologist after systems theory but a 'complexity ecologist', after complexity theory) sees in his own field of work how appropriate Hayek's ideas are. Donald deAngelis states that it is reasonable to think of a complex ecosystem in the same way that Hayek thinks of the market. Just as the market exists as a spontaneous order derived from the chaotic actions of individuals, so the ecosystem exists as the self-ordered product of the species and populations within it. DeAngelis makes clear that he is not the only 'complex ecologist' to proffer such views:

> This view of the ecosystem as arising from the selfish interactions of species populations has been emphasized by some ecosystem theorists. (DeAngelis, 1995)

It may be thought by Postmodern Scientists like Fritjof Capra that there is at least one striking difference between what Hayek says about spontaneous order and what they, themselves, say about it. Hayek as a capitalist must have surely required competition and struggle to be a prime factor in the ordering of chaos. Environmentally conscious philosophers often see their Worldviews as having no central place for competition and struggle. But according to Kley, Frederick Hayek repeatedly and emphatically denied that spontaneous order depended on competition. In fact, Hayek emphasized the idea that individuals freely co-operated when forming associations and transacting in the market place.

Although Hayek's philosophical affinity to the ideas of the New Sciences might be considered scary enough for those contemplating the social and ecological relevance of the Postmodern Sciences, there are some even more disturbing developments for the likes of Capra. In an interesting use of both the self-organization concept and the ecosystems thought of systems ecology, libertarian scholar, Barry Maley, has claimed that the science of ecosystems justifies not protecting ecosystems. This writer believes that since the ecosystem is a prime example of a self-regulating order, then the best thing we could do to save the world's ecosystems is to run our economies like them. Thus, Maley (1994) goes on to suggest, environmental protection must be left to the workings of the market – the only economic system that obeys the self-ordering processes of ecosystems – then ecosystems will actually be protected. Interfere in the machinery of the Market by implementing artificial regulatory regimes such as public reserves, environmental regulation and eco-taxes and the economy will collapse from being self-ordering and the ecosystems will not survive:

> It is the preoccupation with achieving ends quickly, by fiat rather than adaptive process, which characterizes political thinking and command and control makeshift. (Maley, 1994:92)

From this perspective, the ecosystem is held to act in accordance with its own processes only when the social equivalent of those processes – that is unfettered capitalism – is allowed to act. While environmental thinkers such as Capra, Birch and Gare, might regard unfettered capitalism as a major factor in the destruction of ecosystems they unwittingly contribute to a metaphysics that suggests that environmentalism should be based on not directly protecting ecosystems by promoting and celebrating the concept of self-organization.

## Summary

There are a number of ways to interpret the above laid-out relationship between self-organization, the 'order from chaos' idea, neoclassical Free Market ideas, and ecological and environmental practice. A strong interpretation might claim that all self-organization fans, including New Scientists and Postmodern Scientists are, in some way or another engaged in an ideological program to justify Right Wing economic thinking. I, myself, would not advocate such a strong interpretation but would instead advocate a weaker one that might read as follows.

Self-organization believers generally like to think of themselves as valuing freedom. Postmodern Scientists and New Scientists (who are all very fond of the self-organization concept) thus value freedom, you might think. This may be so but just as likely is the idea that Postmodern Scientists and New Scientists know freedom has enormous political and philosophical clout and they attach themselves to its ideals via some (dubious) association between freedom and indeterminacy.

Self-organization theorists also value order. Without it their beloved science cannot see or do anything. What they need to do, then, in order to maximize their rhetorical appeal to various

political discourses, is to entangle both freedom and order together.

Economic liberalists and capitalists also value freedom and order. The freedom of the individual and the order of the Free Market economy. Order, they say, can only exist with such freedom, and freedom can only exist if there is such order. Again Liberal capitalists can maximize their rhetorical appeal by somehow entangling order and freedom together into one.

What is interesting is that Postmodern Scientists along with New Scientists and liberal capitalists do this entangling in a very similar way, and what is more, they both appeal to the same historical and intellectual parentage when doing it. So much so that the language of the order from chaos idea represented in 18th century liberal philosophical ideas is, according to Mayr, understood by both modern day liberal capitalists and modern day New Scientists. It is also apparent that the examples of self-organization of order from chaos which are outlined by Postmodern Scientists (like Fritjof Capra) and New Scientists (like Paul Davies) can help liberal capitalists further their cause (to naturalize and deify economic applications of order from chaos). Also, the examples of self-organization outlined by liberalists (like Hayek) can be utilized by Postmodern Scientists and New Scientists to help further their cause (to arrive at universally true principles of the operation of the cosmos). This is not just a possibility: it is actually happening and can be observed in the writings of people like Ayres, Maley, and Rothschild who not only possess the desire to present universal principles but also have an obvious pro-Liberal Capitalist agenda.

Worse still, for ecologically-minded Postmodern Scientists, the Free Market ideological potential of self-organization theory is also matched by its anti-environmental potential since it can be used to justify a program of local and international conservation

that relies entirely on the Free Market, a tool whose inadequacies in environmental protection most Postmodern Scientists would readily acknowledge.

Yet worse is the way such intellectual processes may interact with the spiritual ideas of Postmodern Science that state that self-organization is a universal, all-embracing and creative God-like force. The implication that flows from the desire to promote the Godliness of self-organization is that there is a danger of deifying all those things that have so far been said to be operating in a self-organizing fashion, such as, for instance the Free Market. If such ideas gain currency in the world of ideas then there might come a time in the near future when the Market becomes classed as a sacred untouchable divine entity worthy of reverence. In such a time, the Free Market will not only be thought of as natural (as Rothschild suggests) but also omniscient, holy and transcendental.

Perhaps the worst thing yet, however, is that we might be living in this time already, and that is why self-organization crosses over so easily from technology to ecological science to economics.

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