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The Semiotics of Global Warming: Combating Semiotic Corruption

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Abstract

The central focus of this paper is the disjunction between the findings of climate science in revealing the threat of global warming and the failure to act appropriately to these warnings. The development of climate science can be illuminated through the perspective provided by Peircian semiotics, but efforts to account for its success as a science and its failure to convince people to act accordingly indicate the need to supplement Peirce's ideas. The more significant gaps, it is argued, call for the integration of major new ideas. It will be argued that Peirce should be viewed as a Schellingian philosopher, and it will then be shown how this facilitates integration into his philosophy of concepts developed by other philosophers and theorists within this tradition. In particular, Bourdieu's concepts of the '*habitus*' and 'field' will be integrated with Peirce's semiotics and used to analyse the achievements and failures of climate science. It will be suggested that the resulting synthesis can augment Peirce's evolutionary cosmology and so provide a better basis for comprehending and responding to the situation within which we find ourselves.

Keywords:
Peirce, Schelling, Lovelock, Bourdieu, climate science, semiotics, Gaia, biosphere, semiosphere, cancer.

Introduction: The On-Going Debate About Global Warming

There is something paradoxical about the present relationship between humanity and the rest of nature. Scientists have been able to interpret a vast array of signs to reveal humanity's impact on the global ecosystem. They have shown that if humanity continues on its present path, the consequences are likely to be disastrous, both for humanity and most other life forms on Earth. However, the measures being taken to address the problem are so paltry that unless something dramatic happens, these measures will delay, only very slightly, the coming catastrophe. What is the relevance of semiotics to this situation?

The discovery of global warming can be characterized as a triumph of human semiosis, revealing the threat to the global environment of continued increases in greenhouse gas emissions and the scale of action needed to prevent global ecological degradation. Al Gore in his film and accompanying book *An Inconvenient Truth,*
a major work disseminating the conclusions reached by scientists, characterized some of this work of interpretation:

> Lonnie and his team of experts … examine the tiny bubbles of air trapped in the snow in the

> year that it fell. They can measure how much CO 2 was in the Earth's atmosphere in the past, year by year. They can also measure the exact temperature of the atmosphere each year by calculating the ratio of different isotopes of oxygen (oxygen-16 and oxygen-18), which provides an ingenious and highly accurate thermometer (2006: 63).

Combining work on such interpretations with computer modeling of weather, climate scientists are now able to project with some confidence what will happen in the future as greenhouse gases increase. All such work has been interpreted and assessed by a working group of several thousand scientists from around the world forming the Intergovernmental Panel on Climate Change (IPCC). This was established in 1988 and it made its first report in 1990. Their very tentative findings were disputed by some scientists, but work continued. In January of 2007 they produced their fourth report, *Climate Change 2007: The Physical Science Basis*, revealing something like a worldwide scientific consensus that there is at least a 90% probability that humans are bringing about a major increase in global temperature.

The findings of this report have not only been published in several languages and reported in newspapers around the world, they are available for downloading through the internet. While there are still diehard skeptics, the consensus reached among climate scientists, personal experience, newspaper reports from elsewhere in the world of unusual weather, together with an increasing number of publications on global warming, appear to be reducing their influence on the general public. Even economists are taking global warming seriously. In September of 2006 the influential journal *The Economist* devoted a special edition to climate change. It reported that while one economist, Robert Mendelsohn, has predicted that a 2.5 °C increase in temperature would result in a fall in global output of 0.1% a year, another environmental economist, William Nordhouse, predicts a fall of 3% of global output, and a reduction of American GDP of 0.5%. In Britain the *Stern Review of the Economics of Climate Change* submitted in October, 2006 and now published argued that a failure to act would lead to a fall in global GDP of at least 5% and could rise to 20% (Stern 2007: vi). Sir Nicholas Stern now believes that because of the reduced capacity of oceans and forests to absorb greenhouse gases, the situation is worse than he thought it was.

Stern's growing pessimism is in line with criticisms of this consensus, much more plausible than those of the skeptics, which has come from other scientists. For instance, a study published by the National Academy of Sciences in May, 2007 has shown that CO 2 emissions are increasing at an accelerating rate. The rate of increase has trebled from 1.1% per year in the 1990s to 3.3% per year between 2000 and 2004. This is worse than the worst case scenario of the IPCC report (Raupach 2007). Each IPCC so far has been more pessimistic than the previous one, and it is likely that the next report will be more pessimistic again. What had been previously judged to be the worst case scenarios are the ones being realized. The major problem is taking into account all the positive feedback loops triggered by further warming. James Lovelock (2006), author of the Gaia hypothesis: the thesis that the global ecosystem functions to maintain the conditions for life on Earth, argues that over the next one hundred years it is likely there will be a massive collapse of life, with only several hundred million people living near the North Pole surviving in a vastly degraded environment that will take more than 200,000 years to recuperate, because even before global warming humans had inflicted so much damage on their environment.

While some countries have been seriously concerned to reduce greenhouse gases, the overall trend is for them to increase. Despite widespread publicity in support of greener sources of energy, no region of the world reduced the amount of carbon used to produce energy between 2000 and 2004 (Raupauch 2007). The governments of countries such as Australia, Canada, China and USA (with the exception of California) have resisted efforts to reduce their emissions and appear to be bent on increasing them. Governments appear to have concluded that if they produce reports and make statements indicating the severity of the problem, then they can avoid acting. Even the most responsible societies are not achieving the reductions that are required to put a stop to global warming. Norway in 1990 set a target of reduced greenhouse gas emissions; by 2010 their emissions will be 150% of their 1990 level. Europeans have had difficulty setting a target of reducing greenhouse gas emissions by 20% with Sweden and Denmark calling for a target of 30%. But the Hadley Centre for Climate Change in 2005 claimed that it would require a 70% reduction in emissions to stabilize existing greenhouse gas concentrations (Hadley Centre: 62). The Stern report recommended stabilizing CO 2e at or below 550ppm (which will still involve significant risks of a catastrophe), requiring the power industry to be at least 60% decarbonised by 2050 (Stern 2006: xi). The report noted that emissions will have to be reduced by 80% to stabilize temperatures, whatever the level (xi). George Mondbiot argued that it will

be necessary to cut carbon emissions by 90% by 2030 to ensure that we do not go over the tipping point, deemed by the German Advisory Council on Global Change to be an increased temperature of 2 ºC, where a runaway greenhouse effect will be unstoppable (2006: 17).

A Peircian Perspective on Global Warming

This description of the discovery of global warming provides *prima facie* justification for attempting to interpret this whole development in terms of semiotics as Peirce conceived it. Science can be construed as a semiotic process of interpreting, producing and reinterpreting signs. It involves hypothesizing to explain unexpected indexes of change, elaborating these hypotheses into models (icons) of these changes to deduce what can be expected in the future, and carrying out investigations to test such changed expectations, then using rhetoric to change the beliefs of others. Here, signs of climate change have generated a long quest by a community of diverse scientists to explain this unexpected phenomenon, hypothesizing a relation between global warming and greenhouse gas emissions, constructing charts and then computer models of this relationship, examining and measuring every sign in nature which could illuminate this hypothesis or test these models, and by considering every argument, gradually moving towards a consensus. It has also generated a concerted effort to convince people that they need to take action and live differently. Can such a semiotic interpretation of our knowledge of global warming and the relationship between this knowledge and people's actions be carried through in detail? And what is achieved by doing this?

Let us look at the second question first. What is the point of attempting to interpret the quest to understand global warming through Peircian semiotics? The main impetus for examining more closely this quest is that there appears to be something radically wrong - an immense problem seems to have been identified by a respectable branch of the scientific community in a way which seems eminently comprehensible as a semiotic process, but contrary to what one should expect from pragmaticist semiotics, humanity is failing to grapple with this problem. Peircian semiotics, because of the breadth of perspective it offers, should be able to bring into focus all facets of this problem. Through semiotics we can examine scientific research, the relationships between different branches of science, between science and public beliefs, government policies, decision-making and ensuing action, and also the relationships between different societies around the world and the relationship between humanity and the rest of nature. Semiotics can provide an interpretation of the situation of humanity necessary for humans to comprehend not only their dire situation but their potential to change accordingly. As Max Oelschlaeger (2001) argued, it is only when we develop a conception of ourselves as a language animal that we are in a position to recognize our potential to transform ecologically maladaptive cultural forms, and this conception of ourselves drives home the truth that, whatever illusions dominate us, cultural processes of selection are ultimately subject to natural selection. Most importantly, Peircian semiotics provides a programme of research to identify where the breakdown is between interpretation and effective action.

Answering the first question, can this semiotic interpretation of the study of global warming be carried through to a conclusion, is problematic in more ways than one. It is clearly a question that should be embraced by proponents of Peircian semiotics as a test of their research programme. But as soon as we attempt to become more precise in our characterization of the study of global warming through semiotics there is the problem of how to interpret the sometimes enigmatic writings and inconsistent terminology of Peirce, to choose between the different formulations by Peirce of crucial ideas or to choose between the vast number of divergent interpretations of his work. This is particularly evident when we look at the divergent interpretations offered by people from different traditions of thought: pragmatists, analytic philosophers, logicians, semioticians, philosophers of science, natural philosophers and metaphysicians. Rather than enter all these debates, I will consider Peirce mainly as contributing to a tradition of philosophy of science and to metaphysics. I believe and will assume (following Joseph Esposito) that Peirce's claim to be a 'Schellingian of some stripe' (CP: 6.605), and his characterization of his philosophy as 'Schellingism transformed in the light of modern physics' (Peirce, 1992: 97), should be taken seriously and that his work can best be understood as developing the tradition of natural philosophy deriving from Friedrich von Schelling (Esposito, 1977a: 202f.; Esposito, 1977b; Esposito, 1980). Generally, this means using the later and more radical of Peirce's formulations of his philosophy (Esposito 1980: 173ff.; Short 2004: 230ff.), and because of the difficulty Peirce complained about of presenting his more radical views, looking for the esoteric content of what he did write. Most importantly, this means interpreting Peirce's analyses of semiosis as

applying to the whole of nature. It is in relation to the Schellingian tradition, I believe, that the achievements, limitations and also importance of Peirce's work in relation to our current situation can be best understood.

Peirce and Schelling

What is involved in seeing Peirce as belonging to the Schellingian tradition of natural philosophy? It is to situate it in relation to and as fundamentally opposed to the mechanistic world view as this developed from Hobbes, Descartes and Newton according to which, as Piece put it, 'the laws of mechanics determine everything that happens according to immutable attractions and repulsion' and that the 'instantaneous state of things from which every other state of things is calculable consists in the positions and velocities of all the particles at any instant' (EP I: 300), while at the same time reacting to the deficiencies in the Idealist reaction against this which privileged consciousness and treated nature as derivative from mind, either individual (in the case of Berkeley and Kant) or collective (in the case of Fichte and Hegel). Most importantly, the Schellingian tradition is committed to doing full justice to both mathematical physics and free human agency while overcoming Cartesian dualism. In this regard it needs to be seen in relation to Kant's argument that the free, unified self-conscious transcendental ego (the unified 'I think' which accompanies all perceptions) is a condition for achieving knowledge of the world and the development of this argument by his followers. Fichte argued that only through mutual recognition between people, whose thought emerges first in relation to action in a world which resists their will, could such self-consciousness be achieved, an argument accepted by Schelling and greatly developed by Hegel. However, Schelling (following H ölderlin) concluded that it is also necessary to conceive the ego as part of and within nature to make intelligible the possibility of self-consciousness. To show that consciousness as conceived by Fichte and Hegel could have emerged within nature it was necessary to reject Kant's solution to the incompatibility of the mechanical view of the world and the assumption of free agency, that is, holding that the mechanical world is mere appearance, the outcome of the organization of the sensory manifold by the productive imagination, the forms of intuition (space and time) and the categories of the understanding. Instead, Schelling argued that our comprehension of human consciousness has to be based on the philosophy of nature (Beiser, 2002: 478), replacing the mechanistic conception of the physical world with a conception of nature as dynamic and creative within which humans as social, self-conscious, creative beings, could have evolved.

While Schelling drew on many sources to develop his philosophy of nature (most immediately, Herder and Goethe), one of the most important was Anaximander, the original proponent of an evolutionary cosmology. Anaximander had argued that the cosmos emerges and develops through the limiting of the unlimited (Seligman, 1962: 121ff.). The influence of this on Schelling is evident in his proclamation:

> Nature philosophy arrives at this explanation simply by virtue of the presupposition that for Nature the permanent is a limitation of its own activity. … For the philosopher, the points of inhibition will be signified by products; every product of this kind will represent a determinate sphere which Nature always fills anew, and into which the stream of its force incessantly gushes (Schelling 2004: 17f.).

To oppose Hegel's idealism, Schelling later went on to argue that there is an unprethinkable being (*unvordenkliches Sein*) which cannot be doubted, the appreciation of which precedes all thought, including scientific and philosophical thought (Snow, 1996: 145ff.) We are in and part of the world we are striving to comprehend, the product of a whole series of nature's limiting itself and our own self-limiting, and our efforts to comprehend the world are developments within nature. Schelling characterized his own philosophy as "neither materialism nor spiritualism, neither realism nor idealism"; but as containing within itself "the opposition of all earlier systems" (Schelling, 1994: 120). However Peirce characterized his own philosophy (Peirce characterized it as 'objective idealism' and 'scholastic realism'), and however others have characterized Peirce's philosophy, this, I believe, is the best description of it. Peirce, in aligning himself with Schelling, was a post-Cartesian, post-Newtonian, post-Kantian, post-Hegelian philosopher grappling with the problems defined by Schelling's project of overcoming the opposition of all earlier systems. In the quest to transcend these oppositions Schelling inspired a tradition of philosophy which includes Henri Bergson, Aleksandr Bogdanov, Alfred North Whitehead and Ludwig von Bertalanffy,

although not all these have been directly influenced by his work. It is in this sense that I believe Peirce should be seen as a Schellingian philosopher, and it is as such that Peirce's ideas will be considered.

Peirce as a Schellingian Natural Philosopher

The key to Peirce's effort to advance Schellingian ideas was his reconception of perception and thought as the production and interpretation of signs, and his reconception of nature to give a central place to signs and their interpretation. Accordingly, he argued that we are free, purposeful agents capable of logical thought having evolved within nature characterized as 'actual reactive existence', which in turn has emerged from 'germinal being' or '*esse in potentia*' (EP II: 180). Germinal being, which Peirce elsewhere characterized as 'a chaos of unpersonalized feeling' (EP I: 297), being without relations, was categorized as monadic, and therefore as belonging to the category of 'Firstness'. This is equivalent to Schelling's 'unprethinkable being', or equivalently, Anaximander's 'unlimited'. 'Actual reactive existence' is the result of nature, through chance, taking on habits, limiting its possibilities and thereby making nature predictable. As habituated, nature consists of 'Brute reactions' or 'Objects' or 'Existents' that resist our actions. Such resistance implies a dyadic relation, and was characterized by Peirce as belonging to the category of 'Secondness'. With dyadic relations we have the conditions for triadic relations, that is, that which belongs to the category of 'Thirdness', and with triadic relations we have the possibility of semiosis – the production and interpretation of signs. In 1907 Peirce offered his most general definition of a sign as that which 'mediates between an object and an interpretant; since it is both determined by the object *relatively to the interpretant,* and determines the interpretant *in reference to the object,* in such wise as to cause the interpretant to be determined by the object through the mediation of the "sign"' (EP II: 410). It is important to emphasize here 'this tri-relative influence' is not 'in any way resolvable into actions between pairs' (Peirce, 1955: 282). Such semiosis involves further limiting of possibilities or determining, in this case of the interpretant by the object through the sign. While the 'interpretant' was understood as the 'meaning' and involved 'a sense of apprehending the meaning', ultimate intellectual interpretants could only be 'habits'; not any habits, but '*self-controlled*
habits' (EP II: 430f.). By habit, Peirce meant a 'conditional general resolution to act' (CP 5.402 n3). This characterization of the interpretant was made on the explicit assumption that semiosis is end-directed; that interpretation can only occur for the sake of some end (Short 2004: 230). Even though they were developed to characterize human semiosis, these very general definitions of signs and interpretants allowed Peirce and his followers to extend the field of semiotics beyond humanity to the study of semiosis in the rest of nature. Peirce suggested that 'all this universe is perfused with signs, if it is not composed exclusively of signs' (EP II: 394).

Peirce's efforts to characterize semiosis in this way was the basis for his solution to how to conceive ourselves as being part of and having evolved within nature. Through an analysis of chance, causation and semiosis he went on show how purposeful behaviour could be understood. Actual causation, as distinct from the causality of cause-effect relations which are really abstractions from causation, consists of events in an ongoing process (Hulswit 2001: 342). Efficient causation 'is a compulsion determined by the particular condition of things… acting to make that situation begin to change in a perfectly determinate way' (EP II: 120). However, Peirce argued that the limiting of possibilities associated with such determination is never complete, so there is still an element of indeterminacy in the universe (EP I: 308). In fact such limiting of possibilities was explained by Peirce as the outcome of chance variations. When types of variations are selected so that there is a practically irreversible tendency, then we can characterize this as a 'final causation' (Short 2004: 330f.). Peirce defined final causation as 'that mode of bringing facts about according to which a general description of results is made to come about, quite irrespective of any compulsion for it to come about in this or that particular way; although the means may be adapted to the end' (EP II: 120). A sign could be seen as a final cause in this way, and as such, could be a purpose. As Peirce put it: 'Every sufficiently complete symbol is a final cause of, and "influences," real events, in precisely the same sense in which my desire to have the window open … influences the physical facts of my rising from my chair, going to the window, and opening it' (EP II: 317). Since nature is not entirely habituated and there are still open possibilities, such purposeful action is to some extent free action. This semiotic account of free, purposeful action involved reworking Kant's analysis of schema of cognition, with productive imagination and understanding unified, and then 'transformed into a creative functioning of habit, dispositional tendencies, or purposive activity as generative of schematic possibilities' (Rosenthal, 2007: 1). A person

was then characterized as 'nothing but a symbol involving a general idea' (EP I: 350), and mind as a semiotic node. In accordance with Fichte's, Schelling's and Hegel's critiques of Kant, this justified an essentially social conception of cognition and thought.

Peirce divided the study of semiosis into three branches, speculative grammar, speculative critic, and speculative rhetoric (where 'speculative' meant 'theory of') (EP II: 297ff.). Speculative grammar studies modes of signifying in general. As Torkild Thelefsen argued, it can only be properly understood through Peirce's evolutionary metaphysics and interpreted in this way enables us to situate the distinctive place of humans and culture within nature (Thelefsen, 2001). Here Peirce attempted to characterize signs and classify all possible signs, concluding at one stage (he later went on to offer further classifications) that:

> Signs are divisible by three trichotomies; first, according as the sign in itself is a mere quality, is an actual existent, or is a general law; secondly, according as the relation of the sign to its object consists in the sign's having some character in itself, or in some existential relation to that object, or in its relation to an interpretant; thirdly, according as its Interpretant represents it as a sign of possibility or as a sign of fact or a sign of reason. (CP: 2.243)

Analysing these semiotic trichotomies and Peirce's classification of signs, Thelefsen suggested that the first trichotomy, the pre-perceptive signs, (Qualisign, Sinsign and Legisign) can be seen as signs of nature, the second trichotomy, the perceptive signs (Icon, Index and Symbol), as signs of humans or human cognition, and the third dichotomy (Rheme, Dicisign and Argument), as signs of culture. The signs of the first trichotomy are monadic; to understand them we are forced to explain something that is inexplicable, but they are the preconditions for the other signs. The second trichotomy, human cognition, is dyadic. It describes a relationship between sign and object without any interpretation. The third trichotomy is triadic and presupposes the previous two, adding to these a further relation. It is only through this third trichotomy that it is possible to understand the relationship between the first and second trichotomies of signs. Humans have evolved from a world of natural signs, so nature is a First, that is, a monadic realm of possibilities. Humans are part of nature but differentiated from it, a Second, that is, a dyadic relation. The capacity to cognize through Icons, Indexes and Symbols has displaced us from nature so that we can only know it through representations. These representations have formed our culture, which is a Third, that is, a triadic relation. But it is through culture that we can understand nature, including our (and our culture's) emergence from it. That is, we think as cultural beings, but can only do so as individual human beings presupposing unprethinkable being and existent objects that have developed within it.

The second and third branches of semiotics are built on and presuppose the first. Speculative critic, is 'the science of the necessary conditions of the attainment of truth' (CP: 1.445), or 'the ways in which a sign can be related to an object independent of it' (EP II: 327). This pertains to what in the speculative grammar is classified as 'argument', and includes the study of abduction, deduction and induction. Abduction is the only logical operation which introduces any new idea. It involves the development of an hypothesis to explain what surprises us, given our previous expectations, and then to 'hold to it provisionally so long as the facts will permit' (Peirce, 1992: 142). Its end is 'through subjection to the test of experiment, to lead to the avoidance of all surprise and to the establishment of a habit of positive expectation that shall not be disappointed' (Peirce 1955: 267). However, he rejected the notion that scientific hypotheses are merely concerned with prediction. It must also connect facts 'with our general conceptions of the universe' (Peirce, 1955: 267). Science and metaphysics are indissociable. 'Find a scientific man who proposes to get along without metaphysics' Peirce wrote, 'and you have found one whose doctrines are thoroughly vitiated by the crude and uncriticized metaphysics with which they are packed' (CP: 1-129). Opposing the positivists Peirce defended 'the intellectual part of our knowledge' (Peirce, 1955: 268). He defended analogy (EP I: 35) and metaphor, noting that 'Metaphysics has been said contemptuously to be a fabric of metaphors. But not only metaphysics, but logical … concepts need to be clothed in such garments. For a pure idea without metaphor … is an onion without a peel' (EP II: 392). However, he never discussed metaphor in relation to abduction. Deduction Peirce characterized as the means by which 'we predict the special results of the general course of things, and how often they will occur in the long run' (Peirce, 1992: 141). Elsewhere he wrote: 'Deduction is the only necessary reasoning. It is the reasoning of mathematics. It starts from a hypothesis, the truth or falsity of which has nothing to do with the reasoning; and of course its conclusions are equally ideal' (EP II: 205) Deduction also deals with probabilities. Inductive reasoning he characterized as 'a course of experimental investigation', and an experiment as 'a question put to nature' (EP II: 215).

The third branch of semiotics, speculative rhetoric, is 'the science of the essential conditions under which a sign may determine an interpretant sign of itself and of whatever it signifies, or may, as a sign, bring about a physical result' (EP II: 326). That is, it is relevant to both examining how people's interpretations of objects are changed and how their actions and ways of living are changed by signs. Peirce ascribed 'photographs, telephones, and wireless telegraphs, as well as the sum total of all the work that steam engines have ever done' to the rhetoric of Bacon's *Novum Organum* (EP II: 326f.) Apart from pointing out the ubiquity of rhetoric, particularly in relation to presenting arguments, Peirce did little work on this aspect of semiosis.

Along with classifying signs, Peirce was also concerned to classify objects and interpretants. Objects were classified as the Immediate Object, 'the object as cognized in the sign' (EP II: 495) or 'the Object as the Sign represents it' (EP II: 482) and the Dynamic Object, 'the really efficient but not immediately present object,' (EP II: 482) or 'the Object in such relations as unlimited and final study would show it to be' (EP II: 495). Dynamical Objects were further classified as 'Possibles', 'Occurrences', or 'Collections' (EP II: 489), and Peirce acknowledged that some Dynamical Objects are 'altogether fictive' (EP II 498). Dynamical Objects were also referred to as 'real objects', and he suggested that a '"real object" … by 'some kind of causation or influence … must have determined the significant character of a sign' (EP II: 409). Elsewhere he referred to them as 'Dynamoid Objects', which he claimed were capable of the three modalities: 'possible', 'existent', and 'Necessitant' (EP II: 480). Dynamical Objects were characterized as what Dynamical or Objective science can investigate (EP II: 495). They are presupposed by Immediate Objects, but can only be indicated by a hint or by being indicated, leaving the interpreter to find them by 'collateral experience' (EP II: 480). These characterizations suggest that Peirce had not fully worked out his definition of Objects, a suggestion supported by his having noted that his division into two classes of Object is incomplete (EP II: 495).

In classifying Interpretants, Peirce also distinguished the Immediate Interpretant ('the Interpretant represented or signified in the Sign') from the Dynamical Interpretant (the 'effect actually produced on the mind by the Sign'), but also recognized a third interpretant, the Normal Interpretant, (the 'effect that would be produced on the mind by the Sign after sufficient development of thought'). (EP II: 482) Later, he referred to the Ultimate or Final interpretant rather than Normal Interpretant, and characterized this as the 'Significance' of the sign; that is, the lessons learnt from the sign (EP II: 498). The Normal or Final Interpretant is the final consensus that communities of inquirers aim at in their scientific investigations.

While Peirce did not discuss the classes of objects and interpretants as extensively as he discussed those of signs, as with his characterization of signs, it is clear that he was concerned to explain the creative activity involved in interpretation as a physical process within nature. It is in his discussion of Objects, and particularly Dynamical Objects, that Peirce is at his most enigmatic, and this, I suggest, is because he was striving to provide a solution to the Schellingian problematic of upholding both what nowadays would be called 'realism' and 'constructivism'.

Through this sketch of Peirce's semiotic theory we can see how Peirce advanced the Schellingian project of conceiving humans as cultural beings which have evolved as part of and within nature, and how this provides the means to characterize reason and explain how the sciences of nature and of humanity are possible, and how people can be understood to act purposively, and how people can be physically changed by arguments.

Re-examining the History of the Discovery of Global Warming

Interpreted in this way, how does Peirce's semiotics illuminate the crisis we are facing, and where is it deficient? First, we need to look more closely at the history of climate science. With the publication of Spencer Weart's *The Discovery of Global Warming,* first as a book and now as an online hypertext, continuously updated, we now have a detailed account of the developments in science which led to the present scientific consensus. It shows this development to have taken place over a much longer time span and to have been far more complex than suggested above.

Work by Joseph Fourier in the 1820s enabled scientists to appreciate that gases in the atmosphere might trap the heat received from the sun and account for the warmth of the Earth above what would be expected from

incoming radiant energy from the Sun alone. However, this possibility aroused little interest among scientists until they began to consider evidence of glaciers having existed throughout Europe in places where they would not be expected. How could these be accounted for? One hypothesis was that the climate of the past had been radically different from climate in the present; at times it had been much colder. It was this which raised interest in whether the composition of the atmosphere could account for vast changes in climate. In 1859, John Tyndall showed that water vapor, carbon dioxide and methane were opaque to infrared light and so could act as greenhouse gases. In 1896 a Swedish scientist, Svante Arrhenius, completed calculations showing that halving the amount of CO 2 in the atmosphere would reduce the temperature of Europe by some 4-5 °C. He then calculated that doubling the CO 2 in the atmosphere would raise the temperature by 5-6 °C, but his main interest was in the causes of the ice ages. However, Arrhenius' colleague, Arvid H ögbom who had been studying how carbon dioxide cycles through natural geo-chemical processes, then calculated the amounts of CO 2 emitted by factories and other sources.

The possibility that CO 2 could cause global warming was dismissed after Knut Ängstr öm experimented with a tube of CO 2 equivalent to the amount of the gas in a column of air to the top of the atmosphere. He showed that CO 2 is so opaque to infrared radiation that doubling the amount of it in the atmosphere would make no difference. Later, meteorologists argued on the basis of spectral absorption studies that the much more plentiful water vapour already blocked the same wavelengths as CO 2, suggesting the amount of CO 2 in the atmosphere was irrelevant. Skepticism generated by this work was reinforced by what became a universal conviction, based on the work of ecologists and biogeochemists such as Vladimir Vernadsky and G.E. Hutchinson, who argued that climate on Earth formed part of a self-regulating equilibrium. The oceans absorb fifty times more CO 2 than enters the atmosphere, and it was assumed that more CO 2 in the atmosphere would stimulate the growth of plants which would restore the balance. Also, more heat would increase cloud cover which would reflect solar radiation.

Consequently, meteorologists initially gave little credence to the lone voice of an English engineer, Guy Stewart Callander who, in 1938, criticised such arguments and again proposed that increasing CO 2 could account for what seemed to be increasing temperatures. His subsequent crusade, however, did revive some interest in the conjecture. Then vastly increased expenditure on meteorological research generated by the military in USA during and after World War II enabled costly experiments to be undertaken which invalidated the arguments against greenhouse gases causing global warming. It was shown that spectral absorption varied at different pressures and temperatures, and CO 2 and water vapour did not have identical spectral absorption lines. Increasing levels of CO 2 would have a greenhouse effect after all. The development of digital computers facilitated calculations of the transmission of radiation through the atmosphere. On this basis Gilbert N. Plass, who was still mainly interested in accounting for the ice ages, suggested that climate change caused by greenhouse gases could be a major problem in the future. Meanwhile, the study of isotopes of carbon and oxygen by Cesare Emiliani using techniques of mass spectrometry and of sampling of sediments using cores was providing means of estimating from fossil forminifera shells the history of temperature changes stretching back nearly 300,000 years (although interpreting the results gave rise to extended disputes). At the same time, studies of ratios of carbon isotopes revealed how much atmospheric CO 2 had been generated by fossil fuels. Work by the oceanographer, Roger Revelle, showed that the oceans would absorb far less CO 2 than previously thought, but this was not taken seriously until in 1959 two Swedish meteorologists, Bert Bolin and Erik Eriksson, clarified the argument. In 1960 C.D. Keeling accurately measured the amount of CO 2 in the atmosphere and detected an annual rise.

Yet given the insignificant contribution by humans to greenhouse gases compared to all greenhouse gases, particularly water vapour, there did not seem to be a problem. That there was a problem became apparent when the atmosphere was again treated as a system, and this time it was realized that systems need not be stable. In the late 1950s a group led by Dave Fultz carried out tabletop 'dishpan' experiments using a rotating fluid to simulate the circulation of the atmosphere. They found that a very slight perturbation could flip the circulation pattern between distinct modes. A small change could effect a huge change. In the 1960s, a Soviet climatologist concerned with plans to redirect rivers away from the Arctic Ocean, Mikhail Budyko, pursued calculations showing how change in ice cover, by changing the amount of radiation reflected, could further the same effect, leading to an ice age or to runaway global warming, challenging the assumption of a global balance. This challenge was reinforced when in 1963 Fritz Möller pointed out that small increases in CO 2, by increasing temperatures, could result in large increases in water vapour, greatly magnifying its

effect.

In the 1970s, however, most scientists still did not see greenhouse emissions as a serious problem. That there was a close correlation between levels of CO 2 and temperature throughout Earth's history was confirmed in the 1980s by analysis of two kilometer long ice core samples from Antarctica. A study published in 1987 showed that over 160,000 years CO 2 levels had varied from 180ppm in cold periods to 280ppm in warm periods. At that time CO 2 levels had already reached 350ppm. Two ice cores taken by rival research teams from Greenland in 1993 revealed that Greenland had sometimes warmed 7 ˚C in less than fifty years, and that there had been dramatic changes in the North Atlantic in as little as five years. In 2005, computer estimates indicated that at present the Earth is now taking in a watt per square metre more than it is radiating back into space over the entire Earth surface.

The study of complex systems using computers suggests that throughout nature, changes which are the linear effects of causes tend to be islands of stability in a more turbulent environment characterized by non-linear relationships, confirming the insights of Futz and Budyko. In such circumstances, changes that appear to be manifestations of linear relationships between causes and effects can lead to bifurcation points where huge changes can occur very rapidly with only very small changes of inputs, moving to a different stable state or even becoming chaotic. Computer models of the climate and ocean currents indicating the possibility of such dramatic changes concurred with the evidence available through the study of ice cores. This in turn revealed that other observations based on examination of tree rings or pollen in sediments revealing dramatic changes in the environment, which had previously been regarded as mere anomalies, should have been taken more seriously. However, appreciation of the possibility of very rapid changes in the environment has not yet been absorbed by geoscientists, let alone economists and the general community. As Weart noted in 2003:

> In the 1950s, a few scientists found evidence that some of the great climate shifts in the past had taken only a few thousand years. During the 1960s and 1970s, other lines of research made it plausible that the global climate could shift radically within a few hundred years. In the 1980s and 1990s, further studies reduced the scale to the span of a single century. Today, there is evidence that severe change can take less than a decade. A committee of the National Academy of Sciences (NAS) has called this reorientation in the thinking of scientists a veritable "paradigm shift." The new paradigm of abrupt global climate change, the committee reported in 2002, "has been well established by research over the last decade, but this new thinking is little known and scarcely appreciated in the wider community of natural and social scientists and policymakers." (Weart, 2003b, 30)

For instance, the melting of permafrost releases methane, which is a much more potent greenhouse gas than carbon dioxide. The West Siberian bog, which has begun to melt, by itself is estimated to contain 70 billion tons of gas, equivalent to 73 years of manmade carbon dioxide emissions at current levels (Monbiot, 2006: 11). Climate scientists at the Hadley Centre for Climate Prediction and Research has predicted that parts of the Amazon rainforest will be turned to desert by 2050, releasing vast amounts of carbon dioxide (Brown, 1998, 1). The most frightening prospect of all is that heating of the oceans could release methane from 'clathrates' (methane hydrates), ice-like substances found in the sea beds around the world. Kept solid by the pressure and cold of overlying water, these contain more carbon than all the reserves of oil and coal in the world put together, all of which could be released very quickly if the temperature of the ocean were increased too much. What we appear to be facing is a cascade of changes generating further warming.

It now appears that the entire rise of human civilization has taken place in a warm period of the Earth's history more stable than at any period in the last 400,000 years (Weart, 2003a: 186). But this stability will only be sustained within certain limits. It is possible that we have already disrupted this regime so severely that these positive feedback loops will overwhelm the negative feedback loops maintaining this stable state, undermining its stability and making its breakdown inevitable. This is the argument of James Lovelock. Lovelock's idea of Gaia, the Earth as a self-organizing system acting teleologically to maintain the conditions for life on Earth, was really a revival and development of the notion of the biosphere developed by Alexander von Humboldt (influenced by Schelling), Eduard Suess, Vernadsky and Hutchinson (Grinevald, 1988), and initially Lovelock, like Hutchinson, had assumed that Gaia was so robust that it would be difficult for humans to adversely affect it. It was others who embraced this concept and used it to

advance concern for environmental destruction. But, following developments in climate science, Lovelock changed his mind. As he put it:

> I knew that our self-regulating Earth had evolved from those organisms that left a better environment for their progeny and by the elimination of those who fouled their habitat, but I never realized just how destructive we were, or that we had so grievously damaged the Earth that Gaia now threatens us with the ultimate punishment of extinction (Lovelock, 2006, 147).

Lovelock has embraced the paradigm shift.

Central to Lovelock's argument are the findings from a study of the Eocene period 55 million years ago. Work on this has been based on research on marine sediments, which can now be dated with some accuracy. A rapid drop in ratios of Carbon-13 to Carbon-12 in fossils at this time can best be explained as due to a massive increase in methane in the atmosphere, possibly caused by the melting of clathrates. The result was a rapid increase in temperature of between 5 ° and 8 °C, with this hot regime lasting for 200,000 years. The methane would have oxidized in the air, and it is this, Lovelock suggests, which would have sustained the temperature change for so long. The effects were dramatic. There is evidence of massive extinctions, and while the poles heated up, with sea surface temperatures at the poles being in the vicinity of 23 °C and supportive of life, the land and oceans at lower latitudes became so hot that they were rendered barren. This meant that the living processes which normally remove carbon dioxide from the atmosphere were greatly slowed down.

The Rhetoric of Global Warming

Along with the emerging consensus within science, there has been a growth of rhetoric by scientists concerned to convince other scientists to take their work seriously and to alert the public and politicians of the need to act to avoid the destructive consequences of global warming. The rhetorical aspect internal to science is associated with the struggle of scientists to convince other scientists to accept their conclusions, to gain co-operation in their research, to gain funding for further research, to form research teams, to develop disciplines and institutions within which research can be supported, and to achieve co-operation between different disciplines and institutions, both within nations and between nations, and to gain practical support from prestigious scientific bodies such as the US National Academy of Science. Influencing the public at large has involved making public statements, attempting to influence journalists and making representations and recommendations to politicians. Rhetorical work involves convincing people that science now has the evidence that global warming is a reality, and that humans are responsible and pointing out what are the likely effects, and consequently the need for drastic action. However, there are complications in such rhetorical work. One of the most important aspects of this is gaining and retaining credibility, of individuals, disciplines, and science itself. In this regard scientists are in a paradoxical situation in that their credibility depends to a considerable extent on being seen to be above economics and politics, but they must somehow gain the economic means to do their work, and this depends largely on having political support. Claiming that we are facing a major threat has served to gain funding for further research, but scientists in the US have come under pressure to misrepresent their findings and those who have spoken out on this issue have sometimes lost funding, and in Australia, have been retrenched. Weart has described this campaign within USA, the resistance it has encountered and its successes.

Weart has also described the growing opposition to these climate scientists. In some cases, opposition has come from other scientists, although generally not climate scientists, and those scientists who have opposed the claims about global warming generally have not published their own claims in refereed journals. However, they have had a major impact because they are widely circulated in publications sponsored by conservative groups and industrial interests. And Weart noted:

> In the forefront was the Global Climate Coalition, generously funded by dozens of major corporations in the petroleum, automotive, and other industries. With slick publications and videos sent wholesale to journalists, plus extensive personal lobbying in Washington and at international meetings, the Coalition did much to persuade leaders who were ignorant of science that there was no sound reason to worry about climate change. Enough of the public was

> likewise sufficiently persuaded by the skeptical advertising and news reports, or at least sufficiently confused by them, so that the administration felt free to avoid taking serious steps against global warming (Weart, 2003: 168).

Weart's account of the work of anti-environmentalists only hints at the immensity of what Monbiot aptly characterized as 'the denial industry' (Monbiot: 20ff.). This involves huge public relations campaigns, setting up or supporting spurious scientific institutes and journals, setting up websites to disseminate misinformation and financing think tanks around the world to mount a misinformation campaign and focus attention away from meaningful action on global warming. The world's largest oil company, ExxonMobil, has been particularly active in this regard, and according to a report by the *Union of Concerned Scientists*, has 'spent millions of dollars to deceive the public about global warming' (Schulman, 2007: 3). Such corporations have also infiltrated legitimate environmentalist groups while setting up bogus environmentalist groups to pre-empt debates on the environment and deflect criticism from business corporations. They have pressured governments to shape government communications on global warming, increase control over academic institutions and to constrain public debate. Most facets of this have been examined by Sharon Beder in *Global Spin: The Corporate Assault on Environmentalism*, which concludes:

> Surveys show that the majority of people in most countries are not only concerned about the environment: they think environmental protection should be regulated by government action and given priority over economic growth. Yet this widespread public concern is not translating into government action because of the activities of large corporations that are seeking to subvert or manipulate the popular will (Beder, 2000: 273).

The most effective strategy pursued by the denial industry is to 'perpetuate the myth of a lack of international scientific consensus on anthropogenic climate change – and thereby succeed in maintaining public confusion' (Antilla, 2005: 350). This has been achieved in newspapers by reporting diverse claims by scientists with the appearance of balance, but failing to distinguish between scientists whose findings have been defended successfully in peer reviewed journals and those scientists bought by the public relations industry to caste doubt on the consensus achieved.

Finally, there is the rhetoric of the environmentalists who broadcast the findings of the scientists, strive to counter the efforts to subvert their message, and point out the implications of this message to the general public. The works of Gore, Weart, Beder and Monbiot are examples of such rhetorical work.

Interpreting Climate Science Through Peircian Semiotics

What light can this more detailed account of the discovery of global warming throw on the adequacy of Peircian semiotics? To some extent, it highlights the superiority of the Peircian semiotic theory of science. What the discovery of global warming shows is the central role and power of abduction in science. The hypothesis that the composition of the atmospheric might account for past ice ages was clearly inspired by experiences that did not fit with expectations, notably evidence of past glaciers where they should not have been. Hypotheses guided inductive research which can best be understood as the interpretation of signs. The development of and incorporation into science of instruments of measurement, enabling a far greater range of phenomena to be appreciated as and interpreted as signs, indicates the underestimated importance of Peirce's semiotic theory of perception, and the importance he accorded to exosomatic devices of thought, to science. Abduction, deduction and induction have guided each other, with abduction being stimulated by failure of expectation, with deductive explication of and demonstration from theories using models, made easier by computers built on the deductive logic that Peirce had participated in developing and induction involving putting questions to nature and searching for signs which could only be interpreted through theories arrived at by earlier abduction. One aspect of semiosis clarified by the development of climate science is the relationship between diverse scientists. Conclusions reached through one enquiry frequently contradicted in some measure conclusions or expectations derivable from conclusions reached in another inquiry, sometimes from different disciplines. Much scientific work involved addressing these conflicts of expectations. Sometimes, this led to conclusions which led to the suppression of ideas which later were seen to be valid. However, it was when expectations deriving from diverse investigations corroborated each other, especially when evidence came from different disciplines, that evidence was found to be most

convincing. Out of this quest for coherence, climate science has evolved towards a general theory of the climate, and more broadly of the Earth as a whole, and in doing so has fitted in with a general movement in science away from a mechanistic world-view which allowed us to look upon nature as a mere resource to be exploited, to a 'process' world-view according to which we have to see ourselves as possibly destructive participants in nature's creative becoming.

Using Peirce's analysis and classification of signs to analyse any particular instance of semiosis is notoriously difficult, as Nathan Houser observed in his introduction to *The Essential Peirce* (EP I: xxxvii). It is not difficult to show in a general way that the development of climate science involved Arguments (abduction, deduction and induction), Dicisigns (propositions) and Rhemes (terms), formulated as Symbols (conventional signs), but utilizing Indexes (such as varieties of pollen in sediments indicating past temperatures) and Icons (as in the diagrams representing the relationship between CO_2 and temperature over time), which in turn were based on the first trichotomy of signs, Qualisigns (qualities, such as the colour of the pollen), Sinsigns (actual existents, the individuals that exist) and Legisigns (general laws, or 'habits' or 'tendencies', or types – the propensity of individual pollen to endure and behave in a certain way which enables them to be identified as types). But it is another matter to classify the sign types (as for instance, whether signs are 'Rhematic, Iconic Qualisigns' or 'Rhematic Iconic Sinsigns') or show that nothing has been left out by this analysis; and later, Peirce developed a more complex analysis of signs based on ten rather than three triadic divisions. What is more significant is that characterizing logic as semiotic and thereby treating humans as embodied and active as well as reflective parts of the world they are investigating has revealed dimensions of science to which Peirce's neo-Kantian and empiricist predecessors and the later logical positivists were blind.

Peirce appears more limited when it comes to comprehending rhetorical work. While he pointed out the ubiquity and variety of efforts to change the ideas of others, he devoted little time to examining ideological struggles, including efforts to deceive, and seemed to have no place for examining the power struggles between political movements of which these ideological struggles are a part. The focus of his work on rhetoric was too limited.

What needs to be looked at to comprehend this deficiency are more fundamental issues associated with Peirce's efforts to explain the possibility of semiosis through which objects of nature are culturally represented by people who are still part of nature. As part of the struggle to overcome Cartesian dualism and the mechanistic world-view, this is one of the most profound aspects of Peirce's philosophy; but it is fraught with difficulties, and it is this that I want to focus upon. In particular, it is necessary to examine more closely the problematic concept of the Dynamical Object. On this basis, I will argue for significant revisions in Peirce's characterization of what exists, which will be used to refine and extend Peirce's causal analysis of semiosis and of teleology. I will examine whether this could be used to justify Lovelock's treatment of Gaia as a living being to which goals are ascribed. This revision will then be used to supplement Peirce's analysis of 'community' in such a way that the complexities of social relations, ideological conflicts and of power struggles can be better comprehended. I will argue that this provides both an explanation for the failure of humanity to respond to the discoveries of climate scientists, and provides the basis for more effective rhetoric in Peirce's sense for environmentalists struggling to achieve a more adequate response to global warming.

The Problem of Objects

What should be almost immediately obvious from Weart's history of the discovery of global warming is that the Dynamic Object being investigated was not global warming as such. Different disciplines with different interests were contributing ideas which eventually led to the overwhelming acceptance by scientists that human emitted greenhouse gases are causing global warming, but the objects being investigated have been for the most part different theoretical objects inaccessible and even incomprehensible to normal experience. The objects that originally had been investigated were the rock formations and marks on rocks which geologists had associated with glaciers being found where, according to their expectations, they should not have been. These came to be seen as signs of ancient glaciers, that is, objects which no longer exist. Originally this was only one of a number of hypotheses and was only accepted after finding collateral evidence for it. Once this had been accepted, then these no longer existing glaciers, or perhaps signs of their

having existed, could be treated as signs of low temperatures.

Interpreting such signs then presented another challenge to previous expectations, calling forth another hypothesis, made possible by Fourier's earlier work, that such changes of temperature could be correlated with changing concentrations in the atmosphere of greenhouse gases. The relationship between temperature and concentrations of different gases then became the object to be investigated. Clarifying the relation between carbon dioxide and temperature over hundreds of thousands of years involved finding signs which could be taken as records of past temperatures. To identify these as signs required advanced physics and chemistry and the development of complex sampling and measuring techniques, which themselves became objects to be investigated in order to uphold the hypothesis that there was such a causal relationship. In the case of Emiliani's argument that the ratio of isotopes of oxygen in fossil forminifera shells was an effect of temperature in the oceans, so that by carbon dating the shells this ratio could be taken as a record of temperature, further work showed the argument to be flawed. Nevertheless, it appeared there is still a correlation. Because during glacial periods more O-16 evaporates than O-18 and then is stored in the glaciers, concentrations of it in the oceans decrease, resulting in less O-16 and more O-18 in the shells. The ratios, in conjunction with ratios of isotopes of carbon, were a record of temperature over time, but only on the basis of a different, more complex causal relationship than Emiliani had hypothesized (Weart, 2003: 49), and ratios could only be characterized in terms of the behaviour of objects such as 'isotopes' which are theoretical constructs. Such work made it possible to deduce that industry emissions of carbon dioxide would affect climate, and it was only against this background that apparent increases in temperature became an object to be investigated and in relation to which signs were then interpreted.

Mere correlations were still not enough, however. Before the significance of changes in levels of carbon dioxide could be properly interpreted it was necessary to have some comprehension of how global climate, oceans, geological and biotic systems functioned as systems and how changes in each could cause changes in the others. Signs that suggested a close relation between greenhouse gases and the temperature of Earth had to be seen as features of a global climate system, which increasingly became the Dynamical Object to be investigated. Initially, this system had been assumed to be fairly stable, and this was the basis for dismissing concerns that human activity, including the emission of greenhouse gases, could disrupt it. But it was recognition of it as a system that allowed scientists to appreciate that it could become unstable, and that it could switch to different regimes, and that a small change could be amplified, triggering major changes to the whole system. Later, it came to be appreciated that it could become chaotic or develop in more complex ways. It also came to be appreciated that the way the climatic system operated could not be understood in complete abstraction from the dynamics of the oceans, from geological processes and from the activity and dynamics of various life forms, ranging from cells to the biosphere, all of which could undergo dramatic transitions to different regimes. It is in this context that the global ecosystem or 'Gaia' emerged as the appropriate object of investigation in relation to which the various correlations and dynamics had to be understood. While this Dynamical Object had been conjectured to exist for some time, it was with the development of computer modeling that its dynamics could be properly appreciated. Along with this, it came to be recognized that the era in which humans have flourished is itself a particular regime or system within 'Gaia'. What these developments reveal is the problematic nature of defining the objects being studied.

What Are Objects?

So what is the status of these objects? As discussed and thought about, they are Immediate Objects, but they are considered as such in relation to Dynamical or Scientific Objects being investigated. There is something right about Peirce's distinction between Immediate Objects and Dynamical Objects, an important element of which is captured by David Bohm when he noted:

> … whatever we say a thing is, it isn't. First of all, whatever we say is words, and what we want to talk about is generally not words. Second, whatever we *mean* by what way is not what the thing actually is, though it may be similar. For the thing is always *more* that what we mean and is never exhausted by our concepts. And the thing is also *different* from what we mean, if only because no thought can be absolutely correct when it is extended indefinitely. The fact that a thing has qualities going beyond whatever we think and say about it is behind our notion of

objective reality (Bohm & Peat, 2000: 8).

Non-fictional Dynamical Objects are parts of the physical universe. But as the history of climate science shows, except in the early stages of investigation, they cannot be simply indicated as that which scientific investigators come across in their engagement in the world, and to the extent that they can be, these early objects of investigation tend to be displaced by theoretically constructed objects. They are, as Gaston Bachelard argued, theoretical objects different from the objects of normal experience (Tiles, 1984: 125). As such they are inter-related, so that examination of a particular object presupposes an understanding of diverse other theoretical objects to make their investigation possible. These theoretical objects constrain what kind of hypotheses can be taken seriously. Does this mean that, as Bachelard argued, science leaves behind the objects of common experience as it develops and finally deals with objects that are simply the products of its own activity? Would this mean that there would only be Immediate Objects? If we accept this, we would have abandoned what appeared to be the solution Peirce had provided to the conflict between realism and constructivism. In the present case, however, Bachelard's neo-Kantian position appears weak, since it is clear that there is something beyond scientific thought in the threat that we face, whether we acknowledge or understand this threat or not. This supports the view, attributed to Peirce by Hausman, that Dynamical Objects are 'centers of resistance' so that 'interpretation is constrained as it grows and is embodied in Immediate Objects' (Hausman, 1987: 389). But when this objective reality is simultaneously postulated to be that which we are talking about, a theoretical construct which involves saying something about it as the condition for us saying something about it, postulated to be the efficient cause somehow determining the signs through which we discuss it, there still seems to be a problem.

How can Peirce's insights be defended? One way of defending Peirce's position is as a form of what Roy Bhaskar called 'transcendental realism'. Partly in response to Bachelard, Bhaskar argued that we must presuppose the reality of theoretical objects of a particular kind (associated with the reality of 'generative mechanisms') as the condition for the possibility of science (Bhaskar, 1994: 45ff.). While this does seem to capture to some extent Peirce's position, Peirce is offering something stronger. Effectively, Peirce is examining the transcendental conditions for any kind of thinking at all, not just scientific thinking. As Thellefsen showed, for Peirce reflective thought presupposes more basic kinds of signs, although it is only through the highest forms that these pre-perceptive signs can be thought about and discussed. This form of analysis derives from Peirce's categories of Firstness, Secondness and Thirdness and underlies all his philosophy. Following Schelling, Peirce took the semiosis involved in action as more basic and as a condition for reflective thought to have any meaning, although this priority could only be defended through reflective thought. Science was then seen not just as ideas about the world but as doing experiments, that is, putting questions to nature without ever being able to be sure what the answers will be, and scientific ideas and concepts presuppose such experiments and the activity of performing them. That is, Peirce assumed that as actors we are bodily engaged in the physical world which confronts us as 'Brute fact' or 'reactive existence'. This world can physically impact upon us according not only to its own tendencies or 'habits', but also to our bodily form. Such engagement with reactive existence presupposes in turn 'germinal being'.

The significance of this for Peircian thought can be clarified through further developments in semiotics; notably, through Martin Krampen's and Kalevi Kull's defence of 'phytosemiotics', the semiosis of plants (Kull, 2000: 326-350). Krampen and Kull have argued that plant growth is itself an interpretant of signs. Kull refers to 'graviperception' which regulates the growth of shoot and root tips (336), but underlying this is the plant's genome, a sign or complex of signs of its environment or ecological niche, including what signs it is likely to find in this. Kull argued that it is not only plants which are characterized by this vegetative semiosis. All animals have vegetative semiosis. For instance, with humans, the developments by the fertilized egg of arms and legs, hands and feet which can grasp and run, and sensory organs of various kinds which are sensitive to various physical objects or processes, are themselves interpretants of signs (i.e. the genome) of their environment, anticipating the characteristics (habits) of what they are likely to interact with in the future (Hoffmeyer, 1996: 20). The genome is clearly an index of the success of the form of the parents to engage with their environments. Action by humans presupposes this vegetative semiosis which is the condition for action. This is the case with scientific experiments as with everyday actions. The reflective thinking which is made possible by and develops on the basis of the forms of semiosis that develop through practical engagement with the environment not only presupposes this animal form of semiosis, but also the vegetative semiosis which makes it possible. As Mark Johnson put it, the body is in the mind (Johnson, 1987). Thus, Peirce is justified in characterizing the nature of the universe as the condition for science prior

to forms of scientific investigation which then reveal the nature of the world in detail.

If Peirce's work can be defended as a form of transcendental realism, the same arguments can be used to defend it as speculative metaphysics. Conceiving it in this way accords with Peirce's own characterization of his work, and despite current attitudes to speculative metaphysics, speculative metaphysics as Peirce conceived it is more defensible than transcendental realism. As with transcendental realism, speculative metaphysics must be concerned to specify the necessary conditions for there to be knowledge of the world, including both the nature of the world itself and the nature of the knower, as essential to achieving a consistent cosmology; but unlike transcendental philosophy, it makes no claim to providing definitive answers. While based on observation (as Peirce argued) speculative metaphysics involves abduction and so is fallible, with no pretensions to certainty. Dealing with the most general features of being, speculative metaphysics is necessarily schematic, providing only an outline of the diverse particulars that are likely to be found in the universe. As Peirce noted, 'Its business is to study the most general features of reality and real objects' (Peirce, 1955: 314). Metaphysics as such then provides a preliminary characterization of any and every thing that could be investigated, and also provides the means to relate diverse inquiries, including diverse scientific disciplines within science and the humanities and inquiries in everyday life, to each other. It provides a bridge between common sense and science. As a characterization of the entire cosmos, it provides the ultimate background against which particular facts need to be connected to be explained. Peircian metaphysics, as a development of the Schellingian tradition, is first and foremost in opposition to the mechanistic cosmology which is still a major force in the world, particularly in Anglophone countries, and it is incumbent upon it to provide an account of the general features of reality and real objects able to account for there being signs and semiosis.

Conceived as speculative metaphysics, it is clear that Piece's work was incomplete. This brings us back to the notion of 'Objects'. Objects are absolutely central to Peirce's theory of semiotics and to his contribution to Schellingian metaphysics, but in Peirce this is a poorly developed notion. Writing for different audiences, Peirce did not attempt to relate his speculations on the Object in the context of semiotics to his metaphysical speculations. So, when characterizing Objects in relation to semiotics he wrote almost nothing about what kind of objects do exist. Where he does engage in metaphysical speculation, he makes not attempt to characterize Objects so that semiosis can be appreciated as an intelligible aspect of them. He focuses on chance and habits within nature whereby nature evolves to become lawful, the concepts of space (suggesting that space is non-Euclidian) and time, logic and mathematics. Existents are briefly mentioned as 'entities' associated with 'the germ of a law', seen as emerging in nature through chance (Peirce, 1992: 210). This is the origin of those parts of nature which, through taking on habits, have become predictable and so can be characterized by generals. But while Peirce claimed that the business of metaphysics is to study the general features of real objects, he offered only brief suggestions on this topic. While he aligned himself with dynamism (defending Boscovich) and argued for the reality of dynamic atoms, suggested that matter might 'consist of vortices in a fluid which itself consists of far minuter solids, these, however, being themselves vortices of a fluid, itself consisting of ultimate solids, and so on in endless alternation' (Peirce, 1955: 68), of points and instants, mentioned objects of various kinds, referred to possibles, occurrences and collectives, molecules, organisms, minds and communities, no general claims were made for how existents sustain themselves in existence. Their endurance was accounted for as the habits of nature, rather than of existents themselves. Where objects are not merely the effects of something else, accounting for them requires some notion of immanent causation.

Where Peirce comes closest to considering immanent causation is in his account of inward nature or *internal cause.*
To begin with, Peirce unraveled the confusion in analyses of cause generated by mixing Aristotelian and modern physics, pointing out the problems in abstracting 'cause-effect' relations from causal processes. At the same time he defended the psychical experience of real becoming against the elimination of real temporality in mechanics (Peirce, 1992: chap.6 & chap.7). Elsewhere, he offered his own characterization of causation. Originally, he suggested three forms of causation whereby events come to pass: external compulsion, inward nature and irregularity (EP I: 299). Later, reworking Aristotle's doctrine of four causes, Peirce divided causes according to whether they were defining or individuating, and whether they were internal or external. He characterized *efficient cause* as the individuating external cause and the *final cause* as the defining external cause, and the *formal cause* or *form* as the defining internal cause and the *material cause*

as the individuating internal cause. Peirce held these internal causes to be part of what is caused (EP II: 315f.). 'Internal cause' appeared to correspond to what earlier he had referred to as 'inward nature'. However, Peirce had little to say on these internal causes. It appears that Peirce lacked the notion of 'self-organization'. He was more concerned to defend the role of chance in nature as the source of necessity, and to justify the concept of final causation. Although Dynamical Objects were characterized by Peirce as 'efficient' and as 'some kind of causation', when he drew his distinction between Immediate and Dynamical Objects his analyses of causation were not mentioned. Nor was his argument that 'Not only may generals be real, but they may also be *physically efficient*
…in the commonsense acceptation in which human purposes are physically efficient' (EP II: 343).

It is possible that Peirce did not want to say much about Objects as such because Dynamical Objects, although able to be indicated, were being treated by Peirce as something like Kantian things-in-themselves, while 'Immediate Objects' included anything that could be thought about (Hausman, 1987; Rosenthal, 1990). Immediate Objects, which can be discussed, are only Dynamical Objects after 'unlimited and final study' (EP II: 495) and so Dynamical Objects could not be properly characterized until there had been unlimited and final study. But on the basis of Peirce's characterization of metaphysics it is necessary to go beyond this promise of future knowledge of Dynamical Objects and attempt to characterize the general features of real Objects. Such a characterization might be 'objectively vague' in the sense that Peirce defended such vagueness (EP II: 351), but it should be considerably more precise, and different, than the common-sense notion of 'object'. The fact that to bring Dynamical Objects into discourse is to render them Immediate Objects, only means that any claim made about them as real objects is fallible and liable to future correction.

Dynamical Objects as Dynamical Processes and Structures

It is in trying to characterize these general features of real Objects that Peirce's metaphysics needs supplementing by the Schellingian tradition – which has been centrally concerned with the notion of 'self-organization'. The most common way of supplementing Peircian semiotics to provide a more adequate notion of Objects is by incorporating the notion of system. Basic Dynamical Objects are assumed to be systems or aspects of systems. But the classic notion of systems as developed by von Bertalanffy does not do justice to Schelling, let alone the full Schellingian tradition. Schelling himself is important for having emphasized that reality is constituted by constant activity which develops by limiting itself. Schelling argued that community of causation or reciprocal action, which in the second edition of *Critique of Pure Reason*
Kant had introduced as a derivative form of causation, was the primary form, with cause–effect relations being abstractions from this (Schelling, 1978: 110). This closely parallels Peirce's defence of 'causation' and his critique of the notion of 'causality' (Peirce, 1992: 198 & 220), but unlike Peirce, Schelling went on to systematically characterize the nature of the existents that emerge in nature. Existents were seen by Schelling as self-organising through being self-limiting, thereby being immanent causes of their own existence. 'Products' (as forms or structures) were seen as being generated by activity and should be seen in relation to this, although the nature of such activity can only be recognized as such through their products (Schelling, 2004: 5f.). The appearance of dead matter in which products prevail over productivity he explained as the outcome of a balance of forces. Organisms were characterized as actively resisting the organizing tendencies within their environment, responding creatively to environmental changes to form and reform themselves as products (Schelling, 2004: 51 & 54). Bergson, strongly influenced by Schelling's philosophy, emphasized the durational nature of becoming, and pointed out that processes vary in their durations (as for instance, a melody requires a longer duration to be a melody than the notes which make it up), this being essential to understanding their relationships. Bogdanov, also strongly influenced by Schelling, developed a general theory of organization and examined the nature of cooperation and conflict between organizations, the kinds of stability they could develop and the crises they could undergo, thereby offering a more dynamic view of existents than mainstream systems theory (Bogdanov, 1984).

More recent work, often only very indirectly influenced by the Schellingian tradition, can also be interpreted as advancing it. Much of this is associated with the study of organized complexity. There is more to complexity theory than the ideas emerging from the Santa Fe Institute's work on complex adaptive systems and non-linear dynamical systems. Before the Santa Fe Institute, Conrad Waddington had characterized his

work as the study of complexity, and developed the notion of self-stabilizing paths of development to characterize epigenesis (the differentiation of cells and generation of form in the development of organisms from embryos), and showed how this notion could be applied elsewhere (1975). This work stimulated the development of catastrophe theory. Howard Pattee, attempting to characterize what distinguishes the living from the lifeless, defined the basic problem in a way reminiscent of Peirce problematic: 'What are the most elementary physical requirements for molecules to function as symbols?' (Pattee, 2001) Influenced by Michael Polanyi's hierarchical ontology, he came to the conclusion that to conceive the possibility of nature representing itself required two irreducibly complementary concepts, dynamical laws and non-integrable constraints. Having introduced the notion of constraint Pattee noted how constraints could be facilitative and creative. For instance, the constraints of grammar make in possible for humans to communicate in much more complex ways than other animals are capable. Pattee spelt out some implications of this notion of constraint for a conception of life generally, including a sketch for a theory of language. He also characterized his work as the study of complex systems (Pattee, 1973).

Pattee's work was a major inspiration for the development of hierarchy theory in which a central place was given to both constraints (limits) and to different process rates (durations) to characterize the relationship between processes, effectively synthesizing Schelling and Bergson without having been directly influenced by either (Allen and Starr, 1982; Salthe, 1985; Lemke, 2000). Those inspired by his work have rethought the concept of causation as constraint (Juarrero, 2002: chap.9), and in this way have developed a more radical form of complex systems theory than the views dominating the Santa Fe Institute. It gives a place for a stronger form of emergence and for creative becoming through the interpolation of new levels of constraint, thereby bridging the gap between science and the humanities (Juarrero, 2002: 222ff.). Despite the hiatus between those influenced by Schelling and Bergson and those developing hierarchy theory, it is difficult not to read the work of such thinkers as Stanley Salthe and Alicia Juarrero as refining and developing their insights and as refining and developing Schelling's, Bergson's and Peirce's characterization of causation, and in fact, Salthe has recognized this heritage (Salthe, 1993: 57f.).

While Salthe and Juarrero still write of systems, which can be considered as 'objects' when they are perceived or discussed, as actual existents they are conceived of as in process of becoming and essentially durational. As such, they are essentially Dynamical Processes, to use a term from Schelling (Schelling, 2004: xxviii & 186), rather than Dynamical Objects. This does not mean that we need to think of all objects investigated by science as Dynamical Processes, but processes are basic and what we can refer to as objects are derivative; for instance stable patterns continually reproduced and maintained by processes, such as the structures of molecules or rock formations, or aspects of processes considered from relatively much faster or much slower rate processes, or metonyms for processes. Processes might be in process of becoming over thousands, millions or billions of years. While time can be represented as an object, to do so does not do justice to its durational, creative becoming. What is the alternative?

It is possible to characterize the appreciation of this durational becoming as a kind of 'feeling', the kind of feeling associated with empathy, and this would accord with the place granted to feeling by Peirce in his characterization of time in relation to mind (EP I: 321f.). Alternatively, we could embrace Bergson's defence of 'intuition' (following Schelling) as a way of knowing by which we grasp reality 'from within' (Bergson, 1965: 162). Another way of characterizing this grasp of reality from within is as 'understanding', but what this means needs clarifying. Polanyi, extending ideas from Gestalt psychology on the experience of being embodied and using tools, provided a fuller characterization and analysis of cognizing or knowing what we are investigating 'from within' as 'indwelling' (Polanyi, 1969: 152ff.). He argued that whatever we focus upon makes sense because it is experienced against a background of which we are tacitly aware. This is the case even when we are explaining the solar system using Newtonian mechanics, but is more obvious in the case of comprehending organisms. Again, music provides a good illustration of what is involved in indwelling (although it does not give an adequate sense of our embodiment). What we hear at any moment is experienced as significant because we 'dwell within' and have a tacit awareness of the whole piece of music as an unfinished process of becoming which functions as the background to what we are currently listening to. To some extent this notion of indwelling bridges the opposition between subject and object, especially when what is 'dwelt within' is a process of becoming. The notion of indwelling in processes of becoming also has the advantage that we no longer have to think of ourselves as outside that which we are investigating and can interpret ourselves as parts of and as participants within such processes of becoming. What I am suggesting is that it is through the cultivation of such tacit awareness by indwelling that we can

appreciate real 'Dynamical Processes' as the 'efficient causes' of (i.e. the constraints determining) the 'Immediate Objects' of our experience, whether these be structures or processes, and more primordially, appreciate the unprethinkable being from which Dynamical Processes, including ourselves, have emerged.

Dynamical Processes and the Semiosphere

What are the implications for this for Peirce's theory of semiosis? Causation as characterized through this more dynamic version of systems theory largely concurs with Peirce's analysis. However, it adds several dimensions. One is that it highlights the durational nature of causal processes, and in doing so highlights the need for there to be hierarchies of organization characterized by different process rates. Salthe argued that there must be at least three levels in these hierarchies to account for semiosis as Peirce described it: one associated with the 'objects' to be interpreted, one associated with the observable signs of these objects, and one associated with the interpretants, which he took to include the observing system (Salthe, 1985: chap.4, esp. p.76; Salthe, 1993: 13ff.). Apart from these levels, there must also be individuals maintaining some measure of identity through change, while maintaining unstable states such that the miniscule inputs from a sign can contribute to realizing one of a range of possible interpretations, and in some cases, generate new structures with new ranges of possibilities. The outcome of one interpretation could involve massive physical changes as civilization and nature are set on one path rather than another. In essence, there must be relative endurance through change able to effect or constrain further change.

This is clearly evident when we examine the science of global warming. The signs that were observable included the ratios of oxygen isotopes in fossil forminifera shells. As noted above, the ratio of oxygen isotopes signified the amount of water held in glaciers when the forminifera were alive, and these in turn signified the temperature on Earth at that time. Forminifera living at different times then provided a record of the Earth's temperature over hundreds of thousands of years. To function as a record the life of individual forminifera through which its shell was developed had to be relatively short compared to the history of climate, but the shell had to endure. Stable structures such as the fixed geometrical relationships between atoms in molecules which make up shells are maintained by a balance of forces which are the product of such very fast rate processes relative to the processes of life. These structures can be treated as enduring individual objects relative to both climate change and to their measurement. Such molecular structures are central to the stability of all solids, including the rock formations left behind by glaciers and the mud on the bottom of oceans. Interpretation of these structures involved a different scale again. After having been obtained, observed and measured, processes of very short duration compared to the dynamics of the global climate (although still long durational compared to the processes maintaining molecular structures), these observations had to be remembered at least long enough for them to be written down in an enduring structure that could be read later. Such observations by scientists presuppose long duration processes associated with the reproduction and development of different scientific traditions, in turn dependent on other cultural processes, including the reproduction and development of educational and research institutions, national communities, and more broadly language communities of civilizations able to read what has been written and pass on from generation to generation not only the capacity to read and understand the significance of such observations, but the significance of educational institutions and science.

To fully appreciate the semiotics of global warming it is necessary to understand all these different levels of activity and their relation to each other. Those arguing that humans can and are having a major affect on the global climate are also showing how these diverse levels have some autonomy (i.e. they are not merely the effect of elementary physical processes as the mechanists would have it). And yet they are more inter-related than previously realized. It is for this reason that broader, more encompassing Dynamical Processes are being recognized as what must be taken as the relevant Scientific Objects to be investigated if we are to properly understand the situation we are in. Lovelock's Gaia hypothesis has come to appear increasingly plausible and relevant. The development of the global ecosystem or biosphere interacting with the atmosphere, hydrosphere and geosphere, a Dynamical Process going back to the early years of the Earth's formation, has maintained the conditions for life and is the context within which various regimes, ecosystems and life forms, including human civilizations, have developed. To comprehend what has been involved in maintaining the conditions for life on Earth, Lovelock has offered a simple model of negative feedback loops involving daisies with black, white and grey petals which could operate to help maintain a stable temperature on Earth despite the increase in temperature of the Sun; but at the same time he has

ascribed purpose to Gaia. For instance he offers a revised evolutionary theory according to which Gaia evolves by removing those organisms that foul their own nest. How can the gap between these two ideas, almost mechanical feedback loops and purpose, be bridged?

Hierarchy theory provides the key to this. It has been used to bridge the gap between two opposed families of theories in ecology, the systems approach and population biology (O'Neill et.al., 1968). The systems approach focused on ecosystems as wholes, examining how they utilize energy and circulate nutrients, but ignoring organisms as such, while the population biologists focused on the interaction between organisms. Both tended to be reductionist in different ways. Hierarchy theorists showed how the interaction between organisms could generate constraints which would serve to maintain ecosystems and recycle nutrients over durations longer than the lives of the individual organisms involved in this. Very often these constraints involve conflict, as successful organisms that threaten the circulation of nutrients within an ecosystem by increasing their numbers then attract predators or diseases which check their destructive influence. Such constraining activity can be characterized as teleological in the sense that it has been defended by Salthe and Juarrero as domination by emergent constraints leading to a final result (Salthe, 1993: 270; Juarro, 2002: 127f.). As Salthe put it: 'constraints from the higher level not only help to select the lower level-trajectory but also pull it into its future at the same time. Top-down causality is a form of final causality' (1993: 270). This can be seen as a final cause as the term was defended by Peirce, that is, a determination of the final result without a determination of the particular way it will be brought about (EP II: 120). From Peirce's perspective, this is the Aristotelian form of teleology which does not yet involve purpose.

However, ecosystems are characterized by semiosis as bacteria, plants and animals interpret their environments and each other, and communicate with each other. Much of this semiosis is associated with organisms struggling for survival without any capacity to appreciate the ecological processes which are the conditions for their survival. However, symbiosis is also a major feature of ecosystems, central to their functioning, and semiosis is particularly important in symbiosis. The semiotic role of flowers in the symbiotic relation between plants and bees is just one example. Here organisms have come to appreciate the significance of the continuing existence of at least some aspect of their environment for their survival. Organisms can be understood as tightly integrated ecosystems, and in such cases, the constraints are largely, and perhaps mostly, semiotic. This is clearly the case in multicelled organisms. In the epigenesis of organisms and their functioning as adults, cell development and reproduction is constrained by emergent, developing fields generated by the interaction between cells (Trainor, 1989). In such cases individual cells interpret their environments and respond by the way they develop, divide or refrain from dividing; in effect they constrain themselves for the common good, their growth being an interpretant of signs of the Dynamical Process of the whole organism of which they are part.

Semiosis is also central to the immune system (Neuman, 2005). Generally, cells in an organism do not destroy each other unless they are identified as foreign to the organism, as damaged, or as threatening in some way the organism's integrity. Damaged cells often self-destruct on instruction by the organism. More complex multicelled organisms develop a number of different semiotic systems to maintain their health (i.e. their wholeness). Only when these constraints break down do cells reproduce without constraint. This is what happens with cancer. Cancer can be regarded as a subversion and corruption of normal semiosis so that the body gets constrained and taken over by the cancerous tumour in a way which ultimately destroys the whole body, including the tumour. While most ecosystems are not integrated to the same extent as organisms, semiosis associated with symbiosis still plays a significant role in the self-maintianing dynamics of the whole. It is in relation to this that we can, following Jesper Hoffmeyer, talk of the development of the semiosphere (Hoffmeyer, 1996: 145), and it is in the context of this that Gaia can be seen to be beginning to act purposefully.

Humanity, and the Semiosis of Gaia: *Habitus* and Fields

What part does humanity play in this semiosphere? Humans coevolved with other species in Africa, and evolved as relatively insignificant components of African ecosystems. Their numbers were kept in check by predators and diseases. However, when they invaded other ecosystems - Eurasia, Australia, the Americas and New Zealand - they had devastating effects, leading in each case to vast numbers of extinctions. The only real opposition to humans came from other humans. So while humans developed more complex forms

of semiosis than had ever previously existed on Earth, and while this facilitated complex forms of cooperation, initially this semiosis in no way served the ecosystems they invaded. Only later, it appears, did humans come to appreciate their environments and through their unique semiosis develop constraints on their interactions with their environments. Subsequent history has been characterized by further advances in semiosis simultaneously augmenting humanity's destructive potential, but also our capacity for self-constraint. Destructiveness has been more common. The early civilizations tended to destroy their environments. Only later, did civilizations such as China and India achieve some kind of balance with the ecosystems of which they were part, and this balance has been broken with modernity. Originating in Europe, modernity has been associated with the conquest and subjugation of most of the world by Europeans, the disembedding of markets from communities (so that communities are subjected to the laws of the market rather than markets being institutions serving the community), industrialization on the basis of fossil fuels and massive environmental destruction, exacerbated by violent or potentially violent competition between increasingly powerful states capable of sustained mass mobilization of resources to dominate the world for access to and control of resources. While the 'war communism' of fascism, Naziism and Stalinism followed by the Cold War fuelled state mobilized economic expansion for much of the twentieth century, a new impetus to this destructive trajectory has emerged with the development of transnational corporations promoting the ideology of neo-liberalism. Under the slogan 'privatise, deregulate, and do not interfere with the market' (Frank, 2001: 5), neo-liberals have severely curtailed what freedom communities had achieved after the Great Depression to control their markets and achieve the liberty to choose their future. If anything, the destructive impact of humanity on the global ecosystem is intensifying as the ideology of modernization and unconstrained markets have penetrated every corner of the world.

Despite this, the capacity for self-constraint also appears to be growing. This self-constraint is connected to the development of the capacity to respect others as other free agents rather than things or objects, and for people to limit their actions on the basis of this assumption (Gare, 2000), organizing the world as a hierarchy of communities of communities. In this way the human semiosphere (as this term was developed by Iurii Lotman (1990: 123ff.)) has augmented the global semiosphere so that, as Lovelock argued, Gaia has become self-conscious (Lovelock, 1979: 147). The global ecosystem has developed a stronger form of telos associated with semiosis, a telos involving a symbol (of the state of health of Gaia) which then influences, or could influence action, in the way Peirce characterized such influence. On this basis it is entirely justified to refer to Gaia as acting, or having the potential to act, purposefully.

It is in the effort to comprehend these two opposing trajectories that it becomes clear that Peircian semiotics in its original form was deficient, and that the root of its deficiency was in its failure to identify and characterize the primary existents as self-maintaining Dynamical Processes, and so to provide a place for considering semiosis in relation to self-maintaining patterns of activity of which it is a part. In the case of human communities, organizations or institutions the semiosis is extremely complex because it simultaneously involves interpretation of the natural environment and of the products of human activity, of the relations between people and of a variety of social forms generated by and then constraining these relations, of the relationship between these different forms, which sometimes support each other and sometimes are at odds with each other, the relationships between different communities or societies, and the situation of individuals engaged in this complex world, all of which are to some extent constituted by such semiosis. That is, the Dynamical Processes which are the objects interpreted are complex and involve inevitable conflicts of interest, yet to a considerable extent are the products of interpretation, so that any efforts to advance interpretation inevitably involves intervening in ideological debates and struggles impacting on different interests.

The most adequate conceptualization of this complexity in a form which can be integrated with Peircian semiotics has been provided by Pierre Bourdieu. Upholding the primacy of practical reason over reflective thought (under the influence of Marx and Heidegger, both of whom had been influenced by Schelling), and responding to the work of the structuralists, Bourdieu developed a way of characterizing practical action which could account for the observations of the structuralists while avoiding their failures. His core concepts were the '*habitus*' and the 'field', each of which is seen to be the product of the other. The *habitus*, Bourdieu defined as:

> … systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures, that is, as principles which generate and organize practices and

> representations that can be objectively adapted to their outcomes without presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to obtain them. Objectively 'regulated' and 'regular' without being in any way the product of obedience to rules, they can be collectively orchestrated without being the product of the organizing action of a conductor (Bourdieu, 1990: 53).

He defined a field as:

> … a network, or configuration, of objective relations between positions. These positions are objectively defined, in their existence and in the determinations they impose upon their occupants, agents or institutions, by their present and potential situation (*situs*) in the structure and distribution of species of power (or capital) whose possession commands access to the specific profits that are at stake in the field, as well as by their objective relation to other positions (domination, subordination, homology, etc.) (Bourdieu & Wacquant, 1992: 97).

Clearly, the notion of *habitus*
has something in common with Peirce's notion of habits, including 'belief-habits' (EP I: 201f.), but several dimensions are added by Bourdieu. To begin with, Bourdieu had identified a form of embodied belief which is neither fully conscious nor unconscious, and had seen that part of this belief is in the reality of the socially constituted fields within which people are acting and striving for 'capital' or power. It is acting on this basis that the field is continually reproduced and developed. While fields are reproduced by the *habitus* of people, at the same time the field engenders this *habitus* in its participants.

This characterization of individuals in fields concurs with Peirce's characterization of individuals as knots in a semiotic net, but provides a better basis for understanding their motivations and the dynamics of communities of which they are part. As noted, individuals participating in the fields are seen by Bourdieu as striving for the 'capital' which will enable them to continue pursuing capital within the field, but they do so in a way that constrains them to uphold and augment the field, and to exclude people who undermine the autonomy of the field. There are various forms of capital, but the most important is 'symbolic capital', essentially prestige or recognition from other members of the field, the kind of recognition that enables them to define and impose their definition of reality. That is, the development of fields is an aspect of the struggle for recognition identified by Fichte and further elaborated by Schelling and Hegel. It is this socially engendered struggle which largely accounts of the dynamics and functioning of fields. The struggle for recognition can account for the emergence of fields in the first place, and then their development. A developing field is a Dynamical Process which maintains and augments its existence. However, individuals are not simply determined by the field, and respond creatively to opportunities as these arise, often changing the field in the process. They also participate in different fields, and change the fields to which they give their primary allegiance. With these notions Bourdieu established a research programme that has enabled us to examine the birth of fields, how they operate to exclude certain people and include others, how they modify the attitudes of their participants and are modified by their participants, and the relationship between fields. The relationship between fields can be very complex as they can form nested hierarchies (as for instance when the field of poetry operates within the field of literature, which operates in the broader cultural field) but which can also be such as to cut across different hierarchies (as when a local field of science is situated within the fields of a national culture but is also within the international field of science).

Re-Examing the Paradoxical State of Modern Civilization

At the beginning of this paper I suggested that there is a paradox in that while humans have identified the causes of and have come to understand the disastrous effects of global warming, collectively they are not responding appropriately. Is this a paradox for Peirce? He wrote in 'Philosophy and the Conduct of Life' that 'pure theoretical knowledge, or science, has nothing directly to say concerning practical matters, and nothing even applicable at all to vital crises. Theory is applicable to minor practical affairs; but matters of vital importance must be left to sentiment, that is, to instinct' (EP II: 33). In the same paper he argued that 'Reason is of its very essence egoistical. … Men many times fancy that they act from reason when, in point of fact, the reasons they attribute to themselves are nothing but excuses which unconscious instinct invents to satisfy the reasoning "why's" of the *ego*'

(EP II: 32). From this perspective, where Peirce appears to align himself most closely with Darwinian thinking, the failure to respond to the threat of global warming is what we would expect. People will continue to act egoistically, occasionally rationalizing their egoism, and the findings of science will have very little impact on the way they behave. On this view, we can expect a shakeout of humanity and other species in which the fittest (presumably the people who have accumulated most wealth to allow them to purchase their way into the future polar civilization, along with the survivors among those they employ to keep the others out and the plants and animals they choose to preserve) will survive, thereby furthering evolutionary progress.

But Peirce was vehemently opposed to Darwinism which 'merely extends politico-economical views of progress to the entire realm of animal and vegetable life', accounting for 'those exquisite and marvelous adaptations of nature' as nothing but the outcome of 'the struggle for existence' between creatures, whereby 'those of them that happen to have the slightest advantage force those less pushing into situations unfavourable to multiplication or even kill them before they reach the age of reproduction' (EP II: 357). His defence of the disinterested pursuit of knowledge in science and philosophy and his own devotion to this were in direct opposition to the utilitarianism and instrumental thinking of the Social Darwinists. Peirce was defending a more subtle position, defending disinterested pursuit of knowledge as the condition for overcoming Social Darwinism; that is, defending the autonomy of the scientific field as the condition for questioning prevailing assumptions about life. Elsewhere he argued that 'the ideas "justice" and "truth" are, notwithstanding the iniquity of the world, the mightiest of the forces that move it' (EP II: 343). Peirce then defended an alternative evolutionary theory. In his essay 'Evolutionary Love', Peirce argued that Darwinian evolutionary theory is deficient and proposed a more complex account of evolution which gave a place to 'evolution by fortuitous variation, evolution by mechanical necessity, and evolution by creative love', which he labeled, respectively, tychasm, anacasm, and agapasm (EP I: 362). That is, Peirce followed Darwin in granting a place to chance variations and selection, but also gave a place to ordered development (associated with epigenesis) and more importantly to emergence generated by psychical endeavour, usually unconscious, fixed by habit which both establishes the new features generated by spontaneous energy, and harmonizes them (EP I: 360). This is 'the formula of an evolutionary philosophy, which teaches that growth comes … from love, from … the ardent impulse to fulfil another's highest impulse …. from every individual merging his individuality in sympathy with his neighbors' (EP II: 354).

What is left out of this account of evolution is any systematic effort to relate evolution to the emergence of new Dynamical Processes, although this is touched on in the essay 'Man's Glassy Essence' where he suggests that corporations might develop minds as incomprehensible to us as we are to our brain cells (EP I: 350), and in his Cambridge Conference Lectures in which he notes that arts, like organisms, manifest their 'internal destiny' to 'grow into pure sciences' (Peirce, 1992: 119). Once such emergence is given a proper place, then there is a paradox, and it can be explained. Effectively, I have been examining this whole situation on the assumption that Peirce's Schellingian optimism is basically correct, but that his development of this tradition is too limited to work out where things are going wrong. With the notion of the cosmos as consisting of emergent self-organising processes and structures which only exist by asserting themselves against the tendencies of their environments, and rethinking the place of semiosis accordingly, it should now be possible to clarify this paradox.

To begin with, it is necessary to understand the achievement of modern science in developing a world-view through which we can now understand some of the dynamics of the global bio-atmo-hydro-geosphere, or Gaia, which engendered us and of which we are part, and to allow us to appreciate how we could be undermining the favourable regime that has emerged within it over the last 10,000 years. The development of science has been associated with the emergence of a global scientific field committed to truth and to providing objective knowledge, despite being dependent upon institutions and organizations of nation-states and the economy which are often in conflict with each other. The scientific field, the philosophical field from which it arose, and the broader cultural fields of which they are part, and the economic and political institutions which support them, are themselves genuine emergents within civilization, within humanity and within nature. To some extent the development of these institutions and fields has been associated with the quest to extend control over nature and to dominate people; however at least as important for understanding the driving force for their emergence and development has been the struggle for recognition, which requires reciprocity to succeed. Bourdieu's analyses of fields show how this struggle for recognition operates in concrete contexts. He showed how the autonomization of these fields engenders the quest for higher ideals,

such as truth, particularly in the case of science (Bourdieu, 1975). It is this struggle for recognition in the context of fields that can account for history developing largely as Schelling conjectured it would towards the creation of 'a federation of all states, who mutually guarantee their respective regimes' (Schelling, 1800/1978: 198). While Schelling held the diffusion of a true legal system as a condition for the development of a universal constitution, he also pointed out there must also be a history of tradition and transmission whereby this ideal can be passed on from generation to generation (200). Clearly, people must also be inspired by this ideal for it to be effective, and it is in this context that the development of art, philosophy, literature and science are of central importance. The realization of this ideal could easily include grappling with the global ecological crisis and embodying in institutions proper recognition of the rest of nature.

However, conceived in this way, it should be evident that it is unlikely that such a development would be achieved smoothly since the ideal is dependent upon conflicting lower level Dynamical Processes, many of which have no sense at all of the broader Dynamical Processes which provide the conditions of their existence, to uphold and sustain it. In the nineteenth century this conflict was associated with colonialism and imperialist rivalries and in the twentieth century with the world wars and neo-colonialism. But such conflict has often been the driving force for the development of the ideal. The League of Nations emerged from World War I and the United Nations from World War II. The development of science underlying the discovery of global warming gained a major boost from the World War II and the Cold War. Science itself involves the transformation of exergy (negative entropy) into entropy and has been made possible through, and has been supported as a means to more effective domination of nature and people and achieving greater access to exergy, the driving forces for increasing greenhouse gas emissions. Because of the underlying conflict and rivalries, not to mention the greed and slothfulness of the beneficiaries of success in such struggles, it was inevitable that there would be strong resistance to efforts to impose constraints on any actors within any field, individual or collective, each of which in its struggles will be striving to impose its own definition of reality to serve its own struggle for power. What we have seen, as Schelling predicted, was a slow process by which humanity evolved into a global community of communities as through conflict people came to appreciate as part of their *habitus* that each field within which they were participating was part of and could only be sustained by a whole hierarchy of differentiated cultural, social, political and economic fields. The extension of this appreciation beyond the global community of humanity to the community of the global eco-system and to Gaia, to some extent foreshadowed by some religions, can be seen as a further unfolding of this logic. But there could be no guarantee of success.

The Globalization of the Market as Cancer

To acknowledge conflict underlying this evolution does not, however, completely explain the extent of the failure to respond to the impending crisis. To understand this it is necessary to look at the new drive to disembed markets from communities associated with the rise of transnational corporations promoting unconstrained markets and consumerism in place of democracy, aligned with authoritarian governments and backed by a new form of neo-imperialism which imposes market relations on resource rich countries by force in the name of 'democracy'. Transcending nation states, transnational corporations have used their power to create a global state which, subverting the project associated with the establishment of the United Nations and the Bretton Woods system of creating an international order of self-determining nations, in alignment with authoritarian governments such as that of China, is transforming the institutions of nation-states into its instruments serving the expansion of the market and corporate growth (Robinson, 2004: chap.3). In so doing they have undermined to varying degrees the partial autonomy of the diverse fields, including nation-states, which had articulated this community of communities, dissolving social life into the global market. It is this expansion that must inevitably accelerate environmental destruction. Barbara Harriss-White in a detailed study has shown how in Britain, where public institutions have been almost totally subverted by neo-liberal policies (Monbiot, 2001: chap.1), every initiative to develop alternative, renewable forms of energy was stymied (Harriss-White, 2006).

How can this be understood? David Korten, author of *When Corporations Rule the World*, offers a plausible diagnosis. He suggested that the growth of unregulated markets is a cancer:

> Cancer occurs when genetic damage causes a cell to forget that it is part of a large body, the

> healthy function of which is essential to its own survival. The cell begins to seek its own growth without regard to the consequences for the whole, and ultimately destroys the body that feeds it. As I learned more about the course of cancer's development within the body, I came to realize that the reference to capitalism as a cancer is less a metaphor than a clinical diagnosis of a pathology to which market economies are prone in the absence of adequate citizen and government oversight (Korten, 2000: 15).

This metaphor of cancer can be extended by interpreting it semiotically. The damaged cells not only forget their position in the whole and proliferate uncontrollably, they corrupt the semiosis within the body and through their rhetoric reorganize the body to feed the growing tumours. If no vital organ is affected, the body eventually dies of starvation.

A feature of transnational corporations is that through massive spending on public relations and advertising, they are corrupting healthy forms of semiosis. The campaign of disinformation on climate change by ExxonMobil and other corporations is only the very tip of the iceberg. As Alex Carey demonstrated in his study of public relations in *Taking the Risk out of Democracy: Corporate Propaganda versus Freedom and Liberty*,
not only have corporations sought to control what politicians and the general public think, they have sought in countries throughout the world to penetrate schools and influence the curricula and co-opt the social sciences to serve their purposes (Carey, 1997: chap.9). In USA they have largely succeeded in gaining control over language, changing the meaning of core concepts such as freedom, liberty and democracy, thereby controlling the framing of every important political debate and making the defence of real democracy extremely difficult (Lakoff, 2004; Lakoff, 2006). Advertising complements public relations. Most artwork in the world at present is devoted to or has been appropriated by the advertising industry (Haug, 1986: 122ff.). Advertising, spending on which increased in USA from $50 billion to $200 billion between 1979 and 1998 (Kline, 199: 11), no longer confines itself to promoting particular products. It promotes a whole way of life symbolized by corporate logos. So, as Naomi Klein noted in her study of the effects of the 'glow' of corporate logos ('loglo'), 'in the late seventies, as the loglo grew brighter, social-justice activism faded; its woefully unmarketable ways no longer held much appeal for energetic young people or for media obsessed with slick aesthetics' (Klein, 1999: 349). Advertising has increased its effectiveness by targeting children. The impact of art outside advertising has been neutralized by reconceiving it as part of the entertainment industry.

It was not just social-justice activism that was weakened, however; the *habitus* of actors within all cultural and political fields sustaining principles and values beyond economic gain has been weakened. The quest for truth, let alone justice, is now experienced as 'not worth the candle' by young people. The effect of this is evident in the higher proportion of students enrolling in the business faculties of universities and the decline of both the sciences and the humanities. The natural sciences are being transformed into techno-sciences only valued for their contribution to profit making, their commitment to truth weakened as scientists and universities have been forced to depend for funding upon targeted government and corporate grants (Dickson, 2000). The effect on the human sciences and the humanities is even more dramatic. The humanities have been almost completely marginalized, and in Anglophone countries sociology and political science have been fragmented to serve particular economic roles. At the same time the influence of economics has increased dramatically.

The rise of economics is not the triumph of science, however. It has been associated with the revival of neo-classical economics, despite the devastating critiques of the fundamental assumptions of this school of thought by institutionalist, political, ecological and mathematical economists, not to mention philosophers (Daly and Cobb, 1994; Mirowski, 1991; Mirowski, 2002; Arthur, 1994; Keen, 2001). This revival is essentially the revival of what Peirce characterized as the 'the conviction of the nineteenth century … that progress takes place by virtue of every individual's striving for himself with all his might and trampling his neighbor under foot whenever he gets a chance to do so.' That is, it is revival of what 'may accurately be called the Gospel of Greed' (EP II: 357). While some economists have struggled to advance economics as a science committed to the truth, such work is largely ignored by mainstream economists whose research funding and consultancy fees depend on providing governments and corporations with the advice they want to hear. The field of economics has lost its autonomy, with the quest for truth being subordinated to the quest for political influence and economic reward, which the discipline itself now legitimates. Economics is

no longer focused on the public good, and Nobel Prizes are awarded to economists who discover new ways of making profits from stock markets. Economists serve the public relations arms of transnational corporations and the emerging global state to legitimate the elimination of trade barriers, the privatization of public assets and the extension of the market to all facets of life. The language of neo-classical economics has been deployed to redefine liberty as the operation of free markets, to defend calculating egoism as a virtue and to foster a belief in endless economic growth (Amadae, 2003: chap.7). The public relations industry has used neo-classical economics to put the market in the place of God as the ultimate Being before which everyone must be judged, and effectively transformed economics from a science into a theology.

By successfully deploying the language of neo-classical economics, promoting the 'user pays' principle and calling for 'accountability', the public relations industry has made it all but impossible to defend the autonomy of cultural, social and political fields. Education is being reconceived as nothing but a business selling the means to make more money and the Humboldtian model of the university is being replaced by the transnational business enterprise model (Readings, 1996), thereby undermining discourses contesting the validity claims of the public relations industry and neo-classical economics. Having achieved overwhelming symbolic power, neo-classical economists have used the language of economics to redefine and thereby mystify the relationship between citizens and politicians (with elections reconceived as markets), workers and employers, producers and consumers, primary producers and industry, and most importantly, between countries extracting raw materials and agricultural products for export and countries involved in high technology production (Hornborg, 2001: 14ff.). And underlying all these developments are the subtle forms of semiotic corruption associated with the commodification of every facet of life and the mediation of almost all human relationship by machine technology (Hornborg, 2001: chap.7 & 8).

The members of the new, corporation based transnational ruling class are aware that their assumptions jar with environmental limits. This is evident in their identification of environmentalists as the greatest threat to their ideal of unlimited corporate growth with a pacified population of consumers. Leslie Sklair has described their proactive response to this: the development of corporate environmentalism promoting 'sustainable development' in order to take the initiative and define the agenda of environmentalism, deflecting anything threatening their power and profits (Sklair, 2001: chap.7). Recently, carbon trading permits have been promoted as a market solution to the problem of global warming, a 'solution' which in practice has proved totally ineffective and blocked more adequate responses based on taxation and rationing. The failure of these 'solutions' does not mean that members of this class are not seriously concerned by ecological destruction; it simply means that their commitment to the global market in which they are the winners is stronger than their commitment to the future of humanity.

Restoring Healthy Semiosis: Maintaining the Autonomy of Fields

In *The Discovery of Global Warming*
Weart concluded by noting the appalling record of corporations and called for efforts 'to improve the communication of knowledge and to strengthen democratic control in governance everywhere' (201). Environmentalists have become increasingly aware that the promotion of strong democracy is crucial to achieving a proper response to environmental destruction. This is not only so because of the destructive imperatives of corporations which in many countries, including USA, are legally obliged to maximize returns to shareholders, which means that subordinating this goal for the common good is illegal. And where corporations do put 'stakeholders' ahead of 'shareholders', as in some European countries, they are dependent on state support the power of which is being undermined by the global market (Gray, 2002: chap.4). But more is involved. It is also because so long as people see their primary role as consumers their goal will be to get as many consumer goods as possible for the least cost, while when they define their primary role as governors, they are obliged to and can be expected to at least think about what is required for the common good of their community (Prugh et.al., 2000: 99). This is even more likely if underlying this people see themselves as creating themselves and their community through their thoughts and actions. The difference democracy makes is evident in the divergent trajectories of Sweden, which still has a strong democracy, and Australia, in which democracy has been almost completely undermined through the neo-liberal policies of its governments. Sweden produces a third of the greenhouse gas emissions per person as does Australia, and is at the forefront of agitation for further reductions, while the Australian government has resisted every effort to curtail its emissions. The problem is how to revive democracy and regain

democratic control over institutions and the economy. Democracy requires healthy semiosis, and this has been severely corrupted. How can this semiotic corruption be overcome?

To begin with, we should note that semiosis has not been entirely corrupted as is evident from the development of climate science and the dissemination of their ideas, resulting in some pressure from the general public to act effectively. Bourdieu's notion of fields and how they develop provides some insight into this. Individuals insofar as they are seen as belonging to and expressing the viewpoint of this highly exclusive field which in the past has demonstrated its commitment to and success in upholding the quest for truth have more symbolic power in society generally, including global society, than can be bought by the most powerful corporations. This is why rhetoric cannot be understood at the level of individual signs. Scientists to influence people must above all maintain the autonomy, integrity and standing of the scientific field and their own standing within this. Healthy semiosis requires is conditional upon maintaining the autonomy of diverse cultural and political fields from the economic field, particularly the global economic field.

Responding to the ecological crisis will to a large extent depend upon success in reversing current trends and augmenting the autonomy of cultural, social and political fields from the economic field, and in particular, from the field of the global economy, and central to this is controlling semiotic corruption and cleaning up semiotic pollution. For instance the power of transnational corporations and media moguls to corrupt and pollute healthy semiosis could be partly checked by heavily taxing or restricting expenditure on advertising and public relations. Of course for a market economy to work successfully people must be informed about products. But markets would function more efficiently if people based their decisions on accurate knowledge rather than rhetoric aiming to undermine their capacity to think rationally. Accurate information would be far better disseminated through channels monitored by a professional civil service committed to the public good. In cases of disputes about claims, rather than advertising or public relations exercises, what is required are courts where producers could present their case that their products are better value than rivals, and have their case judged impartially – by a publicly funded legal system supported by increased taxes on business made possible by the savings they would make on advertising. Public relations also should be considered a matter of establishing the truth, with the role of public relations experts being redefined as the equivalent of advocates in courts of law, employed to ensure that justice prevails. Efforts by corporations to use public relations to deliberately undermine healthy semiosis and to subvert justice should be made illegal, including funding of and lobbying of political parties. Such changes would have the added advantage that they would undermine the bloated profits of the media moguls and public relations firms and return news media to its original role of disseminating news.

The obverse of combating semiotic corruption involves promoting healthy semiosis. In this regard it is necessary to rethink the role of science, the humanities, the arts and particularly education in society. Democracy means the people themselves are the governors of society, so they must be educated and properly informed to be governors, with not only the technical knowledge but the character and wisdom for this. A democratic culture requires the autonomy of science, educational and media institutions to cultivate such knowledge, character and wisdom. Autonomy by itself is not enough, however. Largely autonomous universities have fragmented knowledge over 4000 areas of specialization and denigrated the work of those attempting to overcome this fragmentation, either from within universities or from without. The *habitus* of scientists and academics, to the extent that it does involve a concern with more than getting paid for work, seldom extends much beyond a commitment to their micro-areas of specialization, and many academics have deliberately worked to undermine the autonomy of the academic field (Bourdieu, 1993: 41). It is this fragmentation and disloyalty which has weakened them, greatly facilitating efforts to reduce them to business corporations. The problem is how to overcome academic fragmentation and restore science and educational institutions to health.

Healthy Semiosis and 'Indwelling'

To do this it is necessary to defend something more than the quest for objective knowledge. Peirce argued that all interpretants involve feeling as a sense of comprehending the meaning of a sign. Beyond this, interpretants may involve effort, and some may also include thought. He characterized these respectively as 'emotional', 'energetic' and 'logical' interpretants (EP II: 409). While logical interpretants emerge on a

foundation of feeling and effort, once in the realm of thought, feeling and effort can become attenuated. It is in this state that inquiry can become academic game playing and knowledge can become fragmented. How can this emotional force and coherence of knowledge be regained? And how can a *habitus* be cultivated which involves appreciating at the level of bodily dispositions all the fields which sustain science, culture, civilization, humanity and life? It is here that 'indwelling' should play a role. If it were recognized that interpretation of Dynamical Processes requires indwelling through the use of metaphors and metonyms, and indwelling (or 'understanding') were made central to both science and education, this could re-engage abstract thought with feeling and action and strengthen the *habitus* of people working in fields sustaining a concern for truth, justice and the long term future of life.

The goal of science and education, focused on achieving understanding, would be to facilitate deeper indwelling in the universe as whole and in its emergent Dynamical Processes: in Gaia, in the regime of Gaia which has engendered and sustained human civilization, and with all the complex processes, including the processes of ecosystems and human formations and fields, including the particular local fields within which each individual is participating. This would enable each individual to achieve a sense of their place and role in this cosmos. Indwelling would involve appreciating how Dynamical Processes are related to each other, including how they are supporting or undermining each other. By enabling people to indwell and thereby experience themselves as part of the unfolding drama of nature and civilization, to experience within themselves how the present regime of Gaia is in danger of succumbing to what is really a form of cancer, an impetus could be provided to uphold the autonomy and integrity of diverse fields and reverse the growing fragmentation of knowledge. It appears to be this felt concern for the future of life which accounts for the impressive achievements of climate scientists overcoming disciplinary and national boundaries and integrating work from diverse sources from around the world and to begin to understand the world as a complex of Dynamical Processes.

As it has for climate scientists, the impetus provided by such felt concern for the future of life should accelerate the transcendence of one of the root causes of intellectual fragmentation, the mechanical world-view. This legitimates endless analysis as the best means to accumulate knowledge, and justifies treating knowledge as merely an instrument to control the world. The rejection of this world-view is associated with the advance of transdisciplines such as tektology, systems theory, hierarchy theory, complexity theory and semiotics which enable different disciplines to be related to each other. Such transdisciplines should lead to an appreciation of the importance to science of speculative metaphysics, and the root metaphors they articulate. In the case of semiotics, its development should lead to more attention being paid to Peirce's defence of metaphysics and his suggestion that 'the Universe as an argument is necessarily a great work of art, a great poem, - for every fine argument is a poem and a symphony' (EP II: 194). Speculative metaphysics not only reveals the real choices of research programmes open to science but also the social and political implications of these. Although it is seldom recognized as such, it is the Schellingian tradition which is opening up new perspectives in one area of science after another, invalidating the mechanical world-view on which neo-classical economics, reductionist psychology and Social Darwinism are based and providing intellectual support for the struggle for democracy.

This Schellingian tradition is both changing science and the relation of science to the rest of culture and to nature. As Hornborg, whose work can be interpreted as advancing of the Schellingian tradition, noted:

> The Western mode of understanding reality is well summed up in the word "analysis" – the breaking up of something into its constituent elements. … One such distinction that has been challenged in recent years is between *science*, *ideology*, and *culture*. We still often implicitly distinguish between three such forms of cognition, as if science was *truth*, ideology was *lies*, and culture some kind of quaint, exotic *misunderstanding*. It has become increasingly evident, however, that they all belong to the same supercategory. They are modes of *representation*, modes of producing meaningful images of the world (Hornborg, 2001: 129).

The Schellingian tradition rejects the sharp bifurcation between the natural and the human sciences and the sciences, the humanities and the arts. The 'new alliance' between science and the humanities celebrated by Ilya Prigogine and Isabelle Stengers (1984: 11, 311) is really the triumph of the Schellingian tradition.

Seeing humans as social, free agents within and part of nature requires that not only existing schools of

thought but their assumed disciplinary boundaries should be rejected. In place of neo-classical economics, sociology, anthropology, social psychology and political science, it is necessary to recognize the pre-eminence of human ecology, ecological economics (incorporating institutionalist economics) and culturology (incorporating sociology), and the importance of trasnsdisciplines, including history, tektology, systems theory, complexity theory, semiotics and speculative metaphysics, for interpreting the dynamics of humans in both their relation to each other and to the rest of nature, and as the basis for orienting people for action and forming public policy. Acceptance of this Schellingian tradition also involves rejecting the marginalization of the arts. These should no longer be seen as merely amusements, decorations and investments, but as complimentary to science and philosophy. Music, art, poetry and other literature, cartoons, films and television drama, in so far as they are concerned with truth, should not only facilitate deeper indwelling in the world, but help to reveal its value and inspire people to act accordingly. In this regard, we might heed Peirce's proclamation that 'nothing is truer than true poetry. And let me tell the scientific men that the artists are much finer and more accurate observers than they are, except of the special minutiae that the scientific man is looking for' (EP II: 193). By cultivating deeper indwelling within the Dynamical Processes of which they are part, through incorporating a commitment to these as part of their *habitus*, the actions and lives as well as the ideas of people should themselves become inspiring interpretants of Gaia and the life that is being sustained by its current regime.

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