Ontology and Climate Change

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Abstract

This paper outlines an ontological approach to the climate change problematic, suggesting that what is at stake here has to be conceptualized in terms of our fundamental relation to being. The concept of ontology, as employed in this paper, includes the prevailing scientific understanding of "the ultimate nature of reality" as well as the form of computer-mediated knowledge that provides access to this reality. Also included is what the French philosopher Michel Foucault called "an ontology of ourselves"—that is, an assessment or a questioning of the ontological status of human existence within our overall conception of being.

The three texts analyzed from this philosophical perspective are: a review article summarizing the present state of our knowledge of the global carbon cycle (and emphasizing the limits of such knowledge); a detailed history of the development of mathematical models of global climate, and the computer simulations which provide pictures of global climatological conditions projected decades into the future; and a recent survey of the empirical first indications of climate change as a palpable reality, documenting the onset of sea level rise, melting of permafrost and receding high altitude glaciers. These various approaches to different aspects of the climate change problematic lead to the recognition of the demand for the kind of ontological reflection suggested in the conclusion of the paper.

Introduction

The issue of global climate change has emerged in recent decades as a matter of great concern for contemporary humanity, or more precisely, what we are concerned about are the conditions of the Earth (physico-chemical and biological conditions) that will be "inherited" by *future generations* of our species. At the center of the climate change problematic is the observation of increased levels of carbon dioxide in the Earth's atmosphere, which have accumulated since the Industrial Revolution due to the burning of fossil fuels. This observation becomes troubling in conjunction with the hypothesis, formulated on the basis of complex mathematical models of the Earth's atmosphere, that these increased levels of carbon dioxide will lead to temperature increases and changes in patterns of precipitation sufficient to trigger broad changes in the Earth's biosphere. (We will consider various aspects of this hypothesis, including those projected changes that are already being empirically observed, in more detail below.) Our response to these changes should take the form of technological shifts and innovations, for example, exploiting different possible energy sources, improving efficiencies, and utilizing our current energy sources more cleanly (without producing carbon dioxide, that is.) The climate change

problematic is thus conceptualized as a scientific, technological, and as this paper will emphasize, *informational* problematic.

Ontology, on the other hand, is a branch of philosophy. The word itself was coined in the seventeenth century on the basis of two ancient Greek words designating the area of thinking concerned with a general "theory of being." More specifically, the word refers to the *logos* or rational discourse concerned with *being*—concerned, that is, with "the ultimate nature of reality" or the fundamental layout of the world we inhabit. (I prefer the latter formulation, since the concept of ontology always includes an understanding of *human existence* as well as a general conception of *being* itself. In other words, every general theory about the nature of reality also inevitable includes, in a more or less explicit way, an anthropology: a theory about the "place" of human existence in the totality of the world.) Now, ontology, as the branch of philosophy concerned with being as such, has no obvious connection with the problematic of global climate change. Measurements of atmospheric carbon dioxide levels and predictions of the impacts of continued increase in these levels over the course of coming decades are not usually construed as problems concerned with questions of the ultimate nature of reality. In fact there is an "implicit ontology" taken for granted as part of the modern scientific worldview. Mathematical models and computer simulations that serve as the basis for our knowledge of climate change do not include explicit theories about the fundamental structure of the world we inhabit. And yet, ontological reflection, motivated by thinking through the climate change problematic, may serve to resituate or reconfigure this problematic in unexpected ways.

This paper will attempt to bring together these two very different areas of inquiry: the scientific formulation of the climate change problematic, and the ontological investigation ("the question of being," as Heidegger would say) that arises in a striking way—arises, as I will try to show, *necessarily*—along with this problematic. The relation between these two very different areas of inquiry can be indicated in a preliminary way by considering two possibilities: first, a general theory of being will help us to "situate" global climate change as an event or a development that emerges within our currently prevailing (scientific) understanding of reality. In order to approach the problematic, then, it would be necessary to question the implicit ontology, to render explicit the prevailing conception of being, of our predominant scientific and technological worldview. A second, I think more interesting connection is that something in the very nature of the climate change problematic leads to the necessity of ontological inquiry. That is to say, the enormous scope of the problematic, or its all-inclusive "depth" (starting as it does in the Earth's atmosphere, the problematic reaches down to include the functioning of ecosystems, patterns of agricultural production, and individuals' daily energy use) provoke a certain philosophical reflection that questions our fundamental understanding of the world, and questions as well our human mode of being, our place in the totality of nature, our privileged position in the ordered cosmos that is our world. It is this latter connection between climate change and ontology that will be pursued in the pages below. In the final section of the paper we will refer to two important twentieth century philosophers, Martin Heidegger and Michel

Foucault, in attempting to clarify the direction of the ontological approach to climate change suggested here.

1. Knowledge of climate change: three approaches

We are not primarily interested here in *epistemic* questions—concerning the degree of certainty or precision—regarding our knowledge of global climate change, but rather with *epistemological* considerations. These have to do not with the question of whether or when a certain threshold will be reached, or has already been reached, for example, whereby our anthropogenic forcing of climate change will lead inexorably to catastrophic changes in the functioning of ecosystems, nor with questions of how to determine or predict such a threshold—though these kinds of questions are of great pragmatic importance (ethical and political importance) within the climate change problematic. Epistemological questions, properly understood, involve reflecting on the *conditions of possibility* of a certain kind of knowledge: What is our general understanding of reality, and how do we situate human existence within this reality such that something like a future disturbance of our planetary biosphere emerges as a serious problematic to be dealt with?

Reflecting on the conditions of possibility of knowledge in this way, which is to say, roughly, following Kant, leads to a more specifically *ontological* reflection in the sense indicated above—reflection on our human subjectivity, our mode of existence which is capable of generating a certain type of knowledge, and simultaneously, reflection on the totality of the world as posited (or as it appears) qua object of knowledge. What is "the world" such that we are capable of knowing it as a totality—that is, for us, as a system? And what are we, what is our mode of scientific subjectivity, what is our consciousness (if that indeed is the basis of our knowledge of climate change), such that we are capable today of projecting our knowledge of nature into the future, in order to foresee the consequences of our present and past activities for of our planet's physico-chemical and biological conditions. This, to be sure, is a unique mode of knowledge, and would have been inconceivable for any earlier stage of Western civilization (for the ancient Greeks or Romans, for example, for the Medieval Christian conception or reality, unthinkable even for Renaissance scholars or leaders of the European Enlightenment), inconceivable as well for any non-Western civilization, including those that may well have undermined the conditions of their own existence—without knowing, of course, that they were doing so. The ability to "foresee the future" by means of mathematical models and computer simulations is unique to our current Age of Information. This indicates the epistemological-ontological grounds for our knowledge of climate change.

Our current knowledge claims regarding global climate change are unprecedented in many ways, only a few of which can be touched on here. We are concerned today with the totality of our planetary conditions, so that it is not only one civilization, "the West," whose future is thought to be jeopardized, but what is at stake, rather, is the future of our planetary co-existence, our globalizing world civilization which is implicated in the problematic as both causal agent and potential victim. We are also concerned, on an even larger scale, with the

effects of climate change on the Earth's fauna and flora, with potential losses of biodiversity that may well constitute a mass extinction event which would alter the future course of evolution on this planet. In reflecting on the very nature and scope of such knowledge (eliding for now all questions of accuracy, of timing, of possible mitigation, etc.) we are led to ask not only about "what will happen to us," but to inquire as well into our present mode of human existence: our form of subjectivity, our scientific consciousness that generates such knowledge and produces such future scenarios.

We will return to these inquiries in the second part of this paper under the rubric of what Michel Foucault calls "an ontology of ourselves,"[1] but before doing so it will be useful to look briefly at several aspects of the climate change problematic, in order to be a little more clear about the type of knowledge (or knowledge claims) we are dealing with here. Our sketch will make use of three very different texts, of three different genres, in order to bring out a number of features of our present form of knowledge—knowledge which must necessarily serve as the basis, needless to say, for any response to the problematic. Our first text is a review article of the scientific literature on the global carbon cycle, the complex and only partly understood planetary system at the core of our problematic. The second text is a history of computer modeling of climate change, endeavors which include, among other things, formal mathematical description of the global carbon cycle, as these models have "evolved" over the course of the last fifty or sixty years (coinciding, not by chance, with the emergence and development of digital electronic computing machines). And finally, we refer briefly to a recent survey of the already palpable beginnings of climate change, empirically observable in various parts of the world: melting of polar sea ice, retreat of high altitude glaciers, subtle shifts in the timing of springtime blooms, early indications of sea-level rise, etc. These texts will be discussed only briefly here, and are not intended to give a systematic overview of the problematic (a task which lies beyond the scope of this paper). They function here neither as warnings or calls-to-action nor as grounds for skepticism and hesitation, or calls for further study. The present study makes no pragmatic claim for action or inaction, but attempts to reflect on the philosophical implications of our knowledge of climate change.

A. Knowledge of the Earth as a System

The first text I would like to comment on here is a review article published in the journal *Science* in 2000, and the title of the article hints at our reasons for including it here: "The Global Carbon Cycle: A Test of Our Knowledge of Earth as a System."[2] Two implications leap out immediately

[1] "Here it is not a question of the analytic of truth but involves what could be called an ontology of the present, of present reality, an ontology of modernity, an ontology of ourselves." Michel Foucault, *The Government of Self and Others* (New York: Palgrave Macmillan, 2010) 21.

[2] P. Falkowski, R.J. Scholes, et al., "The Global Carbon Cycle: A Test of Our Knowledge of Earth as a System," *Science* 290, no. 5490 (2000): 291-96. Fifteen co-authors are listed (in addition to Falkowski and Scholes) and there are sixty-five Notes and References. The final sentences of this article makes clear the authors' pragmatic (political)

from this title: first, the form of our knowledge here is such that the object of knowledge is a *system*.[3] And second, the complexities of the global carbon cycle, which includes the carbon dioxide in the atmosphere plus all other forms of carbon on the Earth (in the world oceans, in terrestrial and aquatic ecosystems, in the Earth's crust, etc.), make this object a *test* of our knowledge—that is, a measure of the *limits* of human knowledge. In order to think clearly—that is, scientifically—about the impacts of increased concentrations of carbon dioxide in the Earth's atmosphere, it will be necessary to think rigorously, or as the authors of this article emphasize, as rigorously as such complex and only partially understood phenomena allow, about the interactions between atmospheric carbon and the various "sinks" for carbon in the world oceans and in the totality of the biosphere. Only on the basis of our understanding of biogeochemical flows (the planetary cycles of crucial lelments and nutrients that our biosphere depends on), and on estimates and models of total planetary amounts of various organic and inorganic reservoirs of carbon (measured in gigatons), can we grasp the implications of anthropogenic carbon loading and eventual climate forcing.

In the introduction to the article, the ambitious scope of the study and the daunting task taken on by this team of researchers is clearly stated: "Here we examine some of the changes in biogeochemical and climatological processes concomitant with alterations in the carbon and nutrient cycles in the contemporary world, and compare these processes with our understanding of the preceding 420,000 years of Earth's history."[4] Now, comparison of our present conditions and functioning of planetary cycles with the preceding half million years of Earth's history (as revealed in the ice core record) shows that atmospheric carbon dioxide levels are now significantly higher: 100 ppmv, or parts per million by volume—an increase which is of the same order of magnitude as average concentration itself , estimated at 220 ppmv for the long millennia preceding our modern industrial period. These levels, moreover, have risen faster—much faster—than at any time in our planet's recent past. (Recent, that is, on geological time scales.) It is worth quoting this passage at length, since I would like to pick up on the authors' choice of terminology:

> Atmospheric CO2 concentration is now nearly 100 ppmv higher, and has risen to that level at a rate at least 10 and possibly 100 times faster than at any other time in the past 420,000 years. We have driven the Earth system from the tightly bounded domain of glacial-interglacial dynamics. Are we in a transition period to a new, stable domain? If so, what are the main forcing factors and feedbacks of

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position: "Scientists' abilities to predict the future will always have a component of uncertainty. This uncertainty should not be confused with lack of knowledge nor should it be used as an excuse to postpone prudent policy decisions based on the best information available at the time."

[3] The concept of system (or network) is one of the fundamental concepts of our present epoch, which has come to designate itself as the Age of Information. Other fundamental concepts include *program* (or code) and the concept of *information* itself (or the "unit of information, the binary digit or bit.)

[4] Falkowski, Scholes, et al., "The Global Carbon Cycle," 291.

> this transition? What will be the climatological features of a new domain? What will be the responses and feedbacks of the Earth's ecosystems?5

Our intentions here are not to assess this article's answers to these questions, much less than to follow up on the scientific progress made in the past decade, which has undoubtedly seen enormous research efforts devoted to these and related questions. What I would like to take up here is the suggestion that "we" (presumably all of humanity) are in a transitional period—but not in the sense of a merely historical transition such as the one initiated by the industrial revolution. When these authors state that we have driven the Earth system out of the "tightly bounded domain" defined by the interspersed glacial and interglacial periods (we are presently in the latter phase), they refer to the relatively narrow range of fluctuations in average global temperatures and atmospheric CO2 concentrations. This "domain" is thus a mathematical concept, referring to the region of coordinatedfluctuation, as for example, plotted by means of a Cartesian coordinate system (temperature anomalies vs. atmospheric CO2 levels). But I would like to suggest another interpretation, another meaning, or another register for this use of the word *domain*: what we are entering into is not merely a matter of altered physical parameters, but a new *ontological regime*—quite literally, a fundamentally *new reality*.

The authors note, "Comparison of the present atmospheric concentration of CO2 with the ice core record reveals that we have left the domain that defined the Earth system for the 420,000 years before the Industrial Revolution."[6] Now, if indeed we have left the domain that has "defined the Earth system" for nearly the past half million years, this departure does not only mean that we have moved outside of the mathematical space of "normal" fluctuations in the correlations between global temperatures and carbon loading of the atmosphere; it means, more profoundly, that *human existence itself* will have to fundamentally change—not only as a biological process of adaptation (for human existence cannot be reduced entirely to the biological process of evolution) but *in response to* the planetary regime change we will have instigated. Here the word response indicates our essential capacity for *responsibility*, taken to an entirely new dimension, no doubt, in the problematic we are concerned with in this paper. And the concept of responsibility invoked here, the burden of taking action, that is, in advance of foreseeable cataclysm, on the basis of enormously complex (and thus inevitably uncertain) computer simulations and mathematical models of biogeochemical flows, indicates what is

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[5] Ibid. See the article'sReferences and Notes (pp. 295-6) for the scientific details and citations supporting these remarks. Note, the cybernetic concept of *feedback* invoked here (another of the fundamental ontological concepts of our Information Age) includes both *negative feedbacks*, which might effectively balance or offset temperature increases by, for instance, increased cloud cover which would block a certain amount of solar radiation, preventing it from reaching the Earth's surface, as well as *positive feedbacks*, in which the increase in temperature would lead to effects that would accelerate the driving forces and exacerbate the consequences for ecosystems and human populations. The decreased albedo associated with melting of glaciers and polar ice is a well known example of a "positive feedback loop:" as the ice melts, the darker surface below, whether rock or seawater, absorbs solar energy much more efficiently that the highly reflective ice surfaces, so that the more the glaciers melt the faster they melt.
[6] Ibid.

essentially human in the animal species that has named itself *Homo sapiens*. This heightened, intensified and vastly expanded sense of responsibility marks the ethical dimension of our new ontological regime.

To be sure, in unprecedented ways and with greatly expanded scope, we are burdened with a conscious awareness of potential planetary cataclysm, and compelled to respond, to "react" in advance, as it were, to our novel form of computer-mediated knowledge of the Earth as a functioning system. In formulating this ethical problematic in ontological terms, as the present study is attempting to do in very preliminary ways, we recognize that the new domain of physico-chemical and biological conditions we are entering will also require a new form of human existence: a new self-understanding, new recognition of our powers (and limits), new forms of co-existence with one another and new relations with the whole of nature. When the authors of this scientific review article ask whether we are in transition to "a new, stable domain" they are not posing a merely rhetorical question. We do not know for sure, and cannot predict with certainty, the new parameters of physico-chemical conditions we are bringing about on this planet; but we can sense with a very different "inner" reflection, that contemporary human existence is itself in a transitional state. If we cannot foresee the contours of our new ontological regime, we can be certain that our new form of knowledge of the Earth as system constitutes a radically new object of knowledge, but also a determination of the world we inhabit: as complex, delicately balanced and incredibly fragile set of relations between the totality of human existence and the millions of other life forms with whom we share this Earth. These relations, together with and the physical-chemical flows of matter and energy that constitute our finite environment, constitute the grounds for our knowledge of climate change, as well as the new, calculable, programmable "reality" of our Earth system.

The authors of the review article under consideration here stress the complexity of these systemic relations (biogeochemical flows and regulatory feedback relations) and the inherent limits of human understanding, including in particular, our capacity to predict with certainty the ultimate effects of system perturbations such as a rapid increase in atmospheric carbon dioxide levels. In the final section of the article we find an interesting contrast between information and understanding:

> The global carbon cycle is affected by human activities and is coupled to other climatological and biogeochemical processes. As discussed above, we have considerable ***information*** about specific aspects of the carbon cycle, but many of the couplings and feedbacks are poorly understood. As we drift further away from the domain that characterized the preindustrial Earth system, we severely test the limits of our ***understanding*** of how the Earth system will respond.[7] [Emphasis added.]

[7] ibid. 294. In the article's concluding sentences, the authors specify this inherent uncertainty in terms of our inability to integrate the various sources and various types of information about the "Earth system": "Our present state of uncertainty arises largely from lack of integration of information. Nevertheless, scientists' abilities to predict

Implied here is the claim that uncertainty arises precisely because we are "drifting" into a new Earth system domain (and into a new ontological regime, as I suggest), drifting away from the relatively well regulated domain of correlations between gradual increases in atmospheric CO2 and relatively minor temperature fluctuations In the decade since this overview of the global carbon cycle was published, many observers and commentators have abandoned the idea of "returning" to the preindustrial domain (by reducing anthropogenic CO2 emissions, for example) and the reality we are entering into will henceforth be recognized as a transitional period in which clear foresight and rigorous predictions will be severely limited. As Falkowski and Scholes, et al. indicate in their conclusion, speculation inevitably turns to more drastic and desperate measures that will have to be seriously considered if the "new domain" fails to reach stability—as is quite likely.

> Our present imperfect models suggest that the feedbacks between carbon and other biogeochemical and climatological processes will lead to weakened sink strengths in the foreseeable future [i.e., decreasing capacities for world oceans and ecosystems to absorb excess atmospheric CO2]. This condition cannot persist indefinitely. Potential remediation strategies, such as the purposeful manipulation of biological and chemical processes [on a planetary scale] to accelerate the sequestration of atmospheric CO2 are being seriously considered by both governmental bodies and private enterprises. These mitigation strategies will themselves have unknown consequences [again, on a planetary scale] and must be carefully assessed before any action is taken.[8]

Under the label of "mitigation strategies" the authors refer here to what has come to be known as geo-engineering, literally "engineering the Earth" constiotuted as object of technological manipulation. This indicates one of the defining features of our new ontological regime: reality is programmable.

B. Computer Mediated Knowledge

The second text I would like to comment on briefly is the work of a historian analyzing the evolution of mathematical models of global climate over the second half of the twentieth century. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*, by Paul N Edwards, was published by the MIT Press in 2010. This meticulous and insightful book of more than five hundred pages contains fifty pages of footnotes and citations

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the future will always have a component of uncertainty." (295) That is, even with more sophisticated models with capacities for greater integration of relevant data, our understanding and predictive capacities will be limited.

[8] Ibid. 295.

documenting the various projects of expanding "numerical weather forecasting" into full blown climate models capable of projecting our (still limited) understanding of consequences of climate change into the near term or mid term future. [Most scenarios of interest range from the order of several decades to a century; with much of scientific and public discourse now focusing on developments projected or expected by the end of this century.] In a previous book, the author has studied the emergence of the digital electronic computer in the context of cold war politics and global science policy, and shown that attempts to simulate the Earth's climate were one of the main applications of early computers since the 1950s, offsetting in a way, the other major application, nuclear war scenarios and weapons development.[9]

This crucial background in alluded to in several chapters of the more recent book, but our present concerns are more limited. I would like to reflect on the central thesis of *A Vast Machine*, namely, that *all of our knowledge of climate change is made possible through mathematical models and computer simulations*. The following reamrks, selected more or less at random from many similar statements throughout the book, indicates the crucial epistemological role played by models and simulations in our knowledge of global climate change: "The picture that I hope is emerging here is that *all* knowledge about climate change depends fundamentally on modeling." Or again, "In climate science, models and data are symbiotic. 'Raw data' are noisy, shapeless and uninterpretable. Models give them a definite form. Neither models nor data alone can support a living understanding of physical phenomena." [10]

Now, these remarks are not intended to suggest a version of skepticism toward concerns about climate change. In emphasizing that our knowledge ultimately depends upon models and simulations—and this is true not only for predictions of future climate conditions, but also for our understanding of past and present conditions on a planetary scale—Edwards is *not* claiming that "it's all only a matter of imperfect models"—merely a phigment of our electronically enhanced imaginations The important insight here, rather, is that we are dealing here with a *fundamentally new form of scientific knowledge*, based on supercomputer's abilities to process vast amounts of information in order to produce probabilistic "pictures" of our planetary climate's future. Moreover (and this is the aspect I would like to develop a little further), the situation in which we now find ourselves with regard the climate change problematic, is one in which we are compelled to make profound changes, in the spheres of global governance and economic relations, concerning the crucial sector of energy production, for example, on the basis of this new form of computer-mediated knowledge. This necessity does not, of course, imply that we are already responding or even formulating our eventual responses, but refers instead to a

[9] Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge: The MIT Press, 1996)

[10] Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge: The MIT Press, 2010) Pp. 352 and 418. In focusing on this key insight, that knowledge of the global climate is only possible on the basis of sophisticated mathematical models of complex physical systems (including "couplings" of complex systems such as global atmosphere and world oceans), we pass over all of the valuable research this author has done to chart the development of such models over the past fifty years. Our present interest, as will be seen, turns to the *ontological* implications of this form of knowledge.

profound structural condition of our present ontological order. The problematic we are concerned with here is one in which the future of human coexistence is at stake—on an unprecedented global scale demanding responses that may well be more drastic than anything that human societies have had to face in the past (wars, famines, natural disasters.) But unlike all previous transitions, abrupt or otherwise, which human civilizations have gone through, our attempte to deal with climate change, for better or for worse, will be guided by mathematical models and computer simulations of our planetary future.

The great value of Edwards' book on the evolution of our computational capacities to model and predict climatological responses to perturbations to the Earth's atmosphere is to show that these *information-processing capacities* are the sole and unsurpassable basis for our knowledge of climate change. In speaking of the "ontological implications" of this new form of knowledge I am attempting to point to something that I think is an inevitable and defining feature of our present Information Age: we are increasingly dependent on sophisticated mathematical models (typically over a million lines of programming code, worked on by teams of programmers, with certain modules of the overall program developing over the course of decades) not only for our theoretical understanding of complex phenomena in our world, but our *actual responses* to foreseeable developments will also have to be based on these models and simulations. That is to say, our collective action as human beings in such fundamental sectors as agriculture and energy, our national policies and international efforts to direct and coordinate such policies, will have to be formulated in response to computer simulations of our future planetary conditions. Whether or to what extent or when we might actually formulate such policies is another matter; here we are focusing on this fundamental "structural" feature of our present ontological order. (Which we will return to in the conclusion of this paper.)

C. First Empirical Indications of Climate Change

Having emphasized first, the limits to our theoretical and empirical knowledge of the biogeochemical flows and feedbacks associated with climate change, and then the heavily computer-mediated form of our knowledge of climate change, I would like to turn now to an account of those "early warning signs" to be gleaned in various places around the planet, indicating that climate change in indeed a "reality"[11]—and is very likely already beginning to affect ecosystems and human populations. In *Field Notes from a Catastrophe: Man, Nature and Climate Change*, Elizabeth Kolbert reports on her visits to Alaska, Greenland, the Netherlands and other settings where she interviewed scientists and witnessed firsthand the already palpable impacts of climate change.[12] I will comment briefly on a number of points made by this author in

[11] It is a reality that will alter our very conception of reality: an actual empirical phenomenon that leads us to call into question our prevailing scientific worldview and the status of human existence as the "subject" of this worldview which also appears as an object functioning within the total system of the world.

[12] Elizabeth Kolbert, *Field Notes from a Catastrophe: Man, Nature, and Climate Change* (New York: Bloomsbury, 2009). This book is based on a series of articles originally published in The New Yorker. The second (2009) edition

order to avoid ambiguity by clearly recognizing that climate change is not merely an epiphenomenona generated by supercomputer simulations, but an inevitable reality whose first signs are already empirically discernable. (We do not wish to imply that climate change is merely a *simulacrum*, an Information Age "spectacle" that does not impinge on empirical reality.)

The great value of Kolbert's book is that her "field notes" make a compelling case for the empirical reality of climate change, already perceptible (and measurable) in the gradual melting of vast swaths of permafrost, in rapidly receding Arctic sea ice, and in shrinking glaciers at high altitudes across our planet. These and other developments associated with rising temperatures, rising sea levels, and difficulties in curtailing our dependence on fossil fuels are all discussed with clarity and insight, so that the overall picture of an ensuing "catastrophe" emerges naturally from straightforward reports and informal conversations with experts in various fields engaged in real-world, empirical fieldwork (not mathematical models of ecosystem perturbations). Although some small human populations are already experiencing direct effects of what will eventually become, presumably, a truly *global* change in climate conditions, it is not really accurate to claim that our planetary crisis has already begun. What Kolbert does claim, however, is equally disturbing: given the weakness of political will to address climate change seriously, and our ongoing increase in consumption of fossil fuels, we have almost certainly reached a point where catastrophic change on a planetary scale becomes inevitable—even if we cannot predict exactly *how* the Earth's ecosystems will be affected, or even *when* the broader onset of such catastrophic developments can be expected. The most recent empirical observations and measures of CO2 emissions indicate that, if anything, we have underestimated the urgency of our situation in various ways, for example, by not taking into account other greenhouse gases such as methane, and by underestimating the pace of indistrial growth in China and India, which have both become leading emitters of carbon dioxide over the course of the past decade.

> Just as we have underestimated the dangers of rising CO2, so too have we underestimated the rate at which CO2 levels would rise. Global emissions grew from six gigatons of carbon per year in 1990 to eight and a half gigatons in 2007, an increase of nearly 40 percent. This growth rate exceded the most carbon-intensive projections by the Intergovernmental Panel on Climate Change, making current trends in emissions higher than the IPCC's worst-cast scenario. [. . .] At the same time, according to a report by the Global Climate Project, natural carbon "sinks," like the oceans, are becoming less efficient, meaning that they are removing a smaller proportion of emissions from the atmosphere. 'All of these changes," the report noted, "characterize a carbon cycle that is generating stronger climate forcing and sooner than expected.'[13]

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contains an Afterw0rd in which the author admits to a growing pessimism which had increased considerably since the original publication of the book three years earlier.

[13] Ibid. 198.

The author goes on to ask, tellingly: "What are we to do with this information?"—indicating that even here, in a work purportedly dealing with the empirical reality of climate change, or at least with the first indications of our coming global catastrophe, the real implications are, for us today, still a matter of reacting to *information*. (I will come back to this, in connection with the central thesis of this paper concerning the relevance of ontological reflection, in the concluding section.)

Kolbert's book begins with alarming reportage from a visit to a remote fishing village in Alaska, whose residents have to be moved en masse to another location due to the melting of the no-longer-permanent "permafrost" which their huts have been built on. Obviously we cannot extrapolate from this experience to a global scale. We can only imagine a planet in turmoil as agricultural patterns are disrupted by drastic changes in rainfall, unprecedented migrations from coastal regions lead to geopolitical instabilities, and the world's powerful and wealthy communities struggle ruthlessly to survive in a brave new world of climatological catastrophe. Kolbert's pessimism is basically political in origin; it is not a matter of recognizing our fate as revealed by the sophisticated informatics of climate science. It is difficult to harbor hopes for an efficacious and coordinated response, she explains, given the abject failure of political will thusfar to even seriously attempt to deal with our coming crises. And this failure is all the more disheartening given that climate change is no longer "just a theory" and that ample evidence confirming the first effects predicted by climate models has had no impact on national policies or efforts for international cooperation. It is here that the author cannot help but find cause for despair, concluding reluctantly:

> Americans are more aware of global warming than they were when this book was first published [in 2006], and clearly, more eager for solutions. Yet still they do not seem to appreciate the scale of the effort that is needed. It is hard to look at the evidence objectively and not conclude that the situation is desperate. The pace at which change is occurring, combined with increasingly sophisticated analyses of the paleo-climatic record, has prompted many experts to argue not just that we are racing toward the threshold of 'dangerous anthropomorphic interference' [in the Earth's climatic conditions] but that we have already passed it.[14]

Two points here, in concluding this very partial and somewhat sporadic survey of various aspects of our knowledge of climate change: first, it is indeed true that we do not fully appreciate "the scale of the effort that is needed" in response to what now seems inevitably catastrophic climate change. Since the problematic itself necessarily takes on an ontological dimension, in which our fundamental understanding of reality is called into question and our fundamental self-understanding of human existence itself is put in play, "the effort" and the scale and the scope of our eventual response will also have to be thought, in part at least, at the level of ontology. Second, if it is accepted that we have indeed crossed the threshold that marks our anthropogenic

[14] Ibid. 199.

forcing of climate change as inevitably catastrophic (ruling out, that is, hopes for gradual transition or piecemeal adaptation to new physico-chemical and biological conditions on this planet), then I think we have to recognize thet we are entering quite literally into a *new reality*. We turn now to consider ways to conceptualize this ontological shift, to consider what it might mean to be entering into a new reality, and to establish a new ontological status for the beings we are, individually and collectively, as the initiators (and first casualties?) of this fundamental shift.

2. The Task of "an Ontology of Ourselves" as an Approach to the Problematic of Climate Change

> If there is a certain coherence in what I do, it is perhaps linked to a situation in which we all find ourselves, far more than to a basic intuition or a systematic thinking. This has been true since Kant asked the question "*Was ist Aufklarung?*" that is, what is our own actuality, what is happening around us, what is our present? It seems to me that philosophy aquired a new dimension here.
>
> – Michel Foucault, "What Our Present Is"[15]

In a number of places in his late writings (lectures, essays, interviews) Foucault formulates a certain conception of philosophy as the task of critical-historical reflection on our present reality, which he refers to as "an ontology of ourselves, an ontology of our present." Without going into detail on Foucault's intended meaning, which in any case was never fully expressed, I would like to rejoin this effort of *thinking our present reality* in connection with the problematic of climate change, as already indicated a number of time in the preceding pages. More specifically, I would like to suggest that it may be possible to reformulate the problematic on the basis of such ontological reflection in ways that will prove to be worth pursuing further. The direction and to some extent the implications of such a reorientation or reconfiguration of the problematic have already been hinted at: we will attempt to interrogate the ontological grounds of our present epoch which understands itself explicitly as the Information Age. What is this entity or this concept, information, such that it constitutes, for us, the ground of our reality and the foundations of the world we inhabit?

The text that Foucault invariably refers to in sketching out the task of "an ontology of ourselves" is a brief essay by Kant entitled 'What is Enlightenment?" The great German philosopher was led to inquire broadly into the ongoing historical process called Enlightenment—the "event" as Foucault puts it, that constitutes the historical reality in which Kant lived and thought. In order to situate his own intellectual project within this historical reality, Kant had to address the question of what this term "Enlightenment" actually means. What is going on, in this historical moment, that constitutes our time as a period or process of

[15] Michel Foucault, *Foucault Live: Collected Interviews, 1961-84*, ed. Sylvere Lotranger (New York: Semiotext(e), 1996) 407.

Enlightenment? For us, today, it is not the process of Enlightenment that defines our historical moment, it is the processing of *information*. (I leave aside here any question of the possible connection between the 18th c. self-understanding of Enlightenment and our own late 20th and early 21st c. self-understanding as Age of Information, though it might be interesting to engage in such a comparison.)

For us, today, to engage in an inquiry of "ontology of ourselves" is to ask what it means that our present epoch understands itself as the Information Age. Moreover, as critical-historical inquiry which considers the *conditions of possible knowledge* that are unique to our present epoch, we recognize that the problematic of climate change is only conceivable, only intelligible, within this Age of Information—for reasons hinted at above. It is not only the fact that our knowledge of climate change relies inevitably on highly sophisticated computer models, as Paul N. Edwards has emphasized, nor that our response necessarily bases itself upon adequate or reasonable or "ethical" processing of vast amounts of information representing the Earth's physico-chemical and biological systems, as I have tried to emphasize at a number of points in the foregoing analyses. "An ontology of ourselves" for the Age of Information begins, rather, with the recognition that all of reality is now in principle "available" to us in the form of information, and that we ourselves, as human beings, are determined as processors of information in various ways. Not only insofar as we use the internet, but our biological existence is itself understood ultimately in terms of genetic information; our cognitive functions are understood cybernetically in terms of neural networks; our social and political and economic and educational systems are increasingly understood as programming devices, means of processing information of various types. Virtually all of human existence is now placed on an informational footing, which is hardly surprising since "the ultimate nature of reality," as even the physicists tell us today, is understood to be information.

Given these reflections, what does this "ontology of ourselves" have to contribute to the very real and urgent problematic of global climate change? First, the kind of critical-historical reflection that Foucault wishes to assign (via Kant) as a task for contemporary thinking, is not merely a matter of "reductionism" to our fundamental understanding of being—for example, being as information. The task of an ontology of ourselves, rather, entails a general assessment of the fundamental developments and structures and forms of knowledge that constitute our present epoch in its specificity. In reflecting broadly on the layout of our present reality, then, we would also have to take into account the phenomenon of globalization, developments in biotechnology, the continuing valorization of democracy and free markets (as well as the contesting of the neoliberalism that has reigned in political and economic thinking for the past half century.) Built into the basic structure of our reality, for example, are the related demands or expectations for sustained economic growth, continuous scientific advance, constant and technological innovation. Indeed our response to global climate change will depend largely on our ability to reconfigure this tripartite demand. Part of "the basic structure of our world" is the human claim to privileged ontological status, whether couched in theological terms as the ens creatum granted

priority over all other beings insofar as it was made in the image of the creator God, or understood as the crowning achievement of biological evolution.

An ontology of our present reality would have to take into account these decisive features of the world we inhabit in order to elucidate our underlying epistemological and ontological assumptions, and in particular as these assumptions shore up the privileged position assigned to human existence itself. Such an undertaking clearly goes beyond the scope of our present attempt to point to this ontological dimension as the necessary starting point for reflecting on climate change. "What are we to do with this information?"—information gathered by satellites and ocean temperature gagues, information run through supercomputer simulations and processed by scientists, journalists, policy-makers and citizens—information that "informs us" perhaps in the medieval-Aristotelian sense of *informatio*—that which forms from within? Prior to formulating calls for alternative energy sources and construction of continental sea walls, we should reflect on the fact that our knowledge of climate change comes in the form of highly processed information. This in turn leads to reflection on a fundamental aspect of our contemporary world historical situation. If the phenomenon of climate change is indeed one of the decisive features of our time, it is because it leads us to reflect on the prevailing ontological order in which something like "anthropogenic forcing of planetary climatological conditions" becomes conceivable, perhaps inevitable.

Conclusion: From Metaphysics to Information

> Metaphysics grounds an age, in that through a specific interpretation of what is [*das Seiende*] and a specific comprehension of truth it gives to that age the basis upon which it is essentially formed. This basis holds complete dominion over all the phenomena that distinguish the age. In order that there may be an adequate reflection upon these phenomena themselves, the metaphysical basis for them must let itself be apprehended in them.[16]

Heidegger's pronouncement sounds outdated, today, no doubt, since we no longer think in terms of metaphysical theories as determining the basic conception of reality, or what is understood and lived as reality in different historical epochs. Metaphysics grounds an age—but not ours: our epoch designates itself and determines itself as the Age of Information. To claim or to recognize that the ultimate nature of reality can no longer be understood in terms of matter and energy, but that a somehow prevenient domain of information underlies all empirical

[16] Martin Heidegger, The Question Concerning Technology, trans. William Lovett (New York: Harper & Row, 1977) 115.

manifestation—whatever this may mean[17] - must not be construed as a return to Platonic metaphysics, or any other form of metaphysics. If our "new reality" presents itself in the form of information, our task is to reflect on the decisive features that distinguish our epoch, including for example the problematic of climate change, which has been our focus here, on the basis of this ontological ground. For us today, both the fundamental conception of *what is*, and the specific comprehension of *truth* are determined ultimately in terms of information, which has led us to bring together epistemological-ontological reflections in this paper.

Recognizing this background "interpretation of reality" as the prevailing ground of our knowledge of climate change does not, to be sure, provide us with ready-made answers or solutions. But if Heidegger is right in suggesting that adequate reflection on the decisive phenomena of our epoch depends upon the elucidation of the ontological ground we inhabit, then the approach to climate change suggested here is hardly a matter of ivory tower philosophical speculation in the face of urgent political, economic, technological interventions. In order to formulate the problematic adequately—that is to say, in terms which allow for coming to terms with the ultimate issues and ultimate stakes of the problematic—it will be necessary to begin with what Foucault has called for as an ontology of ourselves.

Implied in this phrase, of course, is the recognition that our ontology is somehow unique, en effect, that we are in the midst of an ontological transition. (In this way, Foucault's late thinking comes close to Heidegger's *Seinsgeschichte*, or history-of-being.) The eventual outcome of this transition will depend, to a great extent, on our ability to deal effectively with the regional, empirical, technological and political-economic problems that will emerge as global climate change proceeds. But our ability to act efficaciously on these pragmatic levels will depend in turn on our capacity for lucid insight into the ontological contours of the reality we inhabit. These contours are themselves malleable (hence the possibility for ontological-historical shifts)—which is not to say programmable. Whether our current ontological regime that determines this epoch as Age of Information proves to be *stable* over the course of coming decades, which is to say, whether it will be possible to construct a habitable and recognizable human reality on the basis of this epistemological-ontological ground, there is no doubt that we will be compelled to negotiate the formidable hazards of climate change on the baisis of mathematical models and computer simulations. Inevitably, the successes and pitfalls of these negotiations—between information and empirical reality—will shape the fundamental contours of the brave new world we are entering. Inevitably, then, the shape of our new world order is to be determined in part by our ability to adequately formulate the problematic of climate change on ontological grounds, as sketched out here in very preliminary ways.

[17] See Paul Davies and Niels Henrik Gregerson, eds., *Information and the Nature of Reality: From Physics to Metaphysics* (Cambridge, UK: Cambridge University Press, 2010) for various attempts to formulate, and make sense of, this informational-ontological thesis.

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