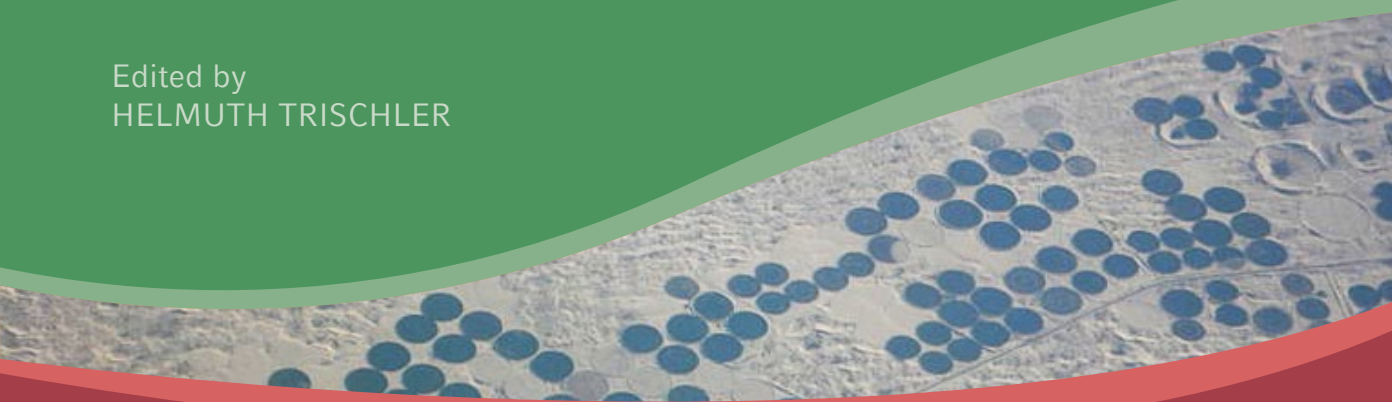
Rachel Carson Center

Perspectives

Anthropocene

Envisioning the Future of the Age of Humans

Edited by
HELMUTH TRISCHLER



2013 / 3

SPONSORED BY THE

Federal Ministry
of Education
and Research

RCC Perspectives

Anthropocene

Envisioning the Future of the Age of Humans

Edited by
Helmuth Trischler

2013 / 3

Contents

Helmuth Trischler

Introduction

Who could have predicted that the concept of the Anthropocene would gain academic currency in such a short period of time? And who would have foreseen that only a dozen years after the term "Anthropocene" was popularized by biologist Eugene F. Stoermer and Nobel Prize-winning atmospheric chemist Paul J. Crutzen, a public campaign launched by the Berlin-based House of World Cultures (Haus der Kulturen der Welt) would literally paper Germany's capital with giant posters featuring the Anthropocene?

These posters—as well as an Anthropocene trailer shown in numerous Berlin movie theaters—feature such puzzling questions as "Is the Anthropocene beautiful?" "Is the Anthropocene just?" and "Is the Anthropocene human?" The campaign's initiators hardly expected to find easy answers to these questions. On the contrary: The questions were deliberately framed as broadly as possible. They aimed at stimulating curiosity about a term that today is still largely unknown to the public. A recent study of visitors to the Deutsches Museum, for example, found that only 18 percent of those interviewed had ever heard of the Anthropocene. A statistically more robust survey that includes a public less interested and less literate in scientific and technical affairs than the visitors to a science and technology museum would very likely reveal even lower numbers of Anthropocene connoisseurs. At the same time, most of the visitors who were interviewed voiced interest in topics related to the Anthropocene, such as climate change and loss of biodiversity, and wished to learn more about them.

The Anthropocene originated from the natural sciences in general and from the earth sciences in particular. The core thesis is that humanity has affected nature over the last two hundred years or so in such a way that a new, human-made stratum has emerged in the geological record. Only a few years after Crutzen and Stoermer popularized the Anthropocene as the new geological "age of mankind," the International Commission on Stratigraphy's Subcommission on Quarternary Stratigraphy established a working group to determine whether there is enough scientific evidence to define a new Earth era. This new era, the Anthropocene, would succeed the Holocene, which started about 12,000 years ago during the Neolithic Revolution, when humans began to use agriculture in addition to hunting and gathering. The Greek word Holocene literally means

"entirely recent," which indicates that there is not much room for moving to something novel in a discipline that usually counts in hundreds of thousands and millions of years. The working group, led by British palaeobiologist Jan Zalasiewicz, thus faces a difficult task in trying to convince its peers to approve the Anthropocene.

While earth scientists discuss the hard facts of geological strata, humanities scholars have started a lively debate about the philosophical, legal, aesthetic, pedagogical, and cultural implications of the Anthropocene. In the last two years, the flourishing field of environmental humanities alone has generated numerous conferences and workshops that try to make sense of the Anthropocene. Most scholars see the Anthropocene as an innovative and broadly conceptualized framework to rethink the relation between nature and culture, environment and society. For them, the Anthropocene thesis goes beyond the core premise that humanity shapes nature to offer new kinds of knowledge production and politics, culture, and lifestyles. Researchers have come together in Berlin and New York, in Stockholm and Sydney, in Munich and Washington, in Beijing and Chicago in large conferences and small workshops to formulate new agendas for research, teaching, and public education. Some scholars have already started to design an Anthropocene curriculum, to carve out an Anthropocene syllabus to engage with the planet as educational material, and to compile an Anthropocene reader that traces the intellectual roots of the hypothesis back in time.

The Anthropocene thesis demands transdisciplinarity. It permeates disciplinary boundaries and challenges established demarcation lines within academia. It is this transdisciplinary set-up that makes the Anthropocene particularly attractive to the Rachel Carson Center, an institution aimed at advancing research and discussion on the interaction between human agents and nature, and at profiling the environmental humanities as a cross-disciplinary field. More than perhaps any other conceptual framework, the Anthropocene requires intellectual openness and stresses the need to bring together scholars from such different intellectual environments as geology and law, theology and literature, and biology and history, to mention just a few. Yet, what looks like a deliberate agenda of the center resulted from contingency. When Reinhold Leinfelder, then newly appointed as a Carson fellow and today also a member of Zalasiewicz's Anthropocene working group, brought up the idea of an exhibition on the Anthropocene some two years ago, he found fruitful soil, all the more so as the center was looking for new ideas to translate its research agenda into a public exhibition. Since then, many more RCC

scholars, including both staff and fellows, have joined in; a vivid intellectual environment has emerged that engages scholars from very different intellectual backgrounds. Moreover, the center has joined forces with the House of World Cultures in Berlin, which launched a large-scale "Anthropocene Project" in 2012. Other institutions have joined in, including the Max Planck Society and the Institute for Advanced Sustainability Studies in Potsdam, to mention only the German-based partners of a quickly growing Anthropocene network that spans the globe.

This volume emerged from multiple scholarly platforms at the RCC: from presentations in the center's lunchtime colloquium, from discussions at its annual retreat, from debates in its doctoral program, from disputes in workshops and conference sessions, from conceptual meetings of its exhibition team, and finally from many informal gatherings over lunch and around the coffee machine. Its transformation from these multiple forms into a coherent volume is thanks in no small part to RCC editor Brenda Black, who has translated, edited, fact-checked, and proofread in record time. A work in progress in the true sense of the word, this volume presents fresh perspectives on the Anthropocene hypothesis, contributing to and stimulating the discussion.

Reinhold Leinfelder

Assuming Responsibility for the Anthropocene: Challenges and Opportunities in Education

Introduction

The Anthropocene is a scientific hypothesis based on the assumption that humanity has become a global Earth system factor in sectors such as water circulation, climate, biological productivity, biodiversity, geobiochemical cycles, sedimentation patterns, and overall use of lands and seas (Crutzen and Stoermer 2000; Crutzen 2002; Williams et al. 2011). If this hypothesis is correct, and all available data corroborate its correctness, it has a great range of implications.

It is necessary to understand that the previous epoch, the Holocene, has definitely come to an end and will not be reestablished ever. Our current social and economic systems, such as agriculture, permanent settlements, transport and trade infrastructures, and the large-scale division of labor, all developed during the relatively stable environmental conditions of the Holocene. Now, however, we have managed, inadvertently and unconsciously, to strain these same environmental conditions to their limits. Ethically, the Anthropocene emphasizes that all of us—from individuals to states to the United Nations—are collectively responsible for the future of the world. Conceivably, the same force that previously wrought unintended changes could be used in a conscious and reflected manner to create a world that is sustainable on a regional as well as global scale for many generations to come. As a conceptual framework, the Anthropocene could hence provide a solid basis for envisioning a sustainable human presence on Earth in which humans would no longer be "invaders" but rather participants in shaping the natural environment. In the future, technology and culture could be integrated into nature—and thus the "unnatural" environment that surrounds us today would be transformed into a human-designed neo-natural environment that includes culture and technology as an integral part of an interconnected system (Leinfelder et al. 2012).

Assuming such responsibility, however, means that transforming nature into even more human-made environments must be based on scientific knowledge and large-scale

participation of society to find the possible pathways to a sustainable future. Efforts to shape a sustainable Anthropocene of tomorrow must also follow the precautionary principle: where there is a suspected risk of harm to humans or the environment, efforts should be made to reduce these risks even if there is not yet definitive scientific proof about the causes.

Given the fact that our scope for action is limited by our knowledge, and that there is no single one-size-fits-all path to a solution, societal and individual responsibility will be of paramount importance. Society will have to legitimize science and technology, focusing in particular on education as one of the most powerful tools for transformation, in order to make the Anthropocene long-lasting, equitable, and worth living. Boundaries between science and the education process will probably vanish, giving way to new transdisciplinary approaches, with science and society interacting in a great variety of new ways. In other words, education for the Anthropocene encompasses a great array of challenges as well as opportunities. This paper attempts to outline some of them and presents a couple of practical examples on the way towards a necessary reorganization of educational systems.

Understanding the State of the Planet—an Educational Challenge

Nearly everybody is aware of the fact that humans exert influence on Earth systems processes. However, almost no one is actually aware of the magnitude of these effects. Recent data illustrate how realistic the Anthropocene hypothesis actually is: about 77 percent of all (ice-free) land surface cannot be considered pristine; it is in use by humans or has been at one time. The world is no longer characterized by biomes, i.e., natural sets of habitats, such as wild forests, savannas, or shrublands, but rather by "anthromes," i.e., cultural landscapes, such as managed forest, cropland, pasturelands, and urban areas. About 90 percent of primary plant productivity happens in these anthromes. Pollen, one of the key elements that helps us characterize natural environments in the fossil record, is dominated by just a few cultivated plant species worldwide. Invasive organisms also alter future sediments, as will plastic particles and other human-processed matter. Fish populations are strongly overfished and partially collapsed. Our present extinction rate is assumed to be at least 100 times higher than during normal episodes of Earth history development. Atmospheric carbon dioxide has never been as high during the

entire history of humans as it is now. More than 50 percent of all freshwater is managed by humanity. Nitrogen oxides and sulfur dioxide emissions are now higher than their natural counterparts, and the mean erosion rate is now up to 30 times higher than during the average of the last 500 million years. At the same time, dams filter out sediment load from rivers, causing deltas to retreat and local sea levels to rise, because the eroded material is no longer being redeposited (e.g. Crutzen 2002; Wilkinson 2005; Rockström et al. 2009; Williams et al. 2011). This list could easily be continued.

Understanding Systemic Interactions and Feedbacks in a One-World System

Education about environmental problems, when it occurs at all, usually presents them as discrete and isolated, often prioritizing certain problems over others. Is it more important to address climate change than biodiversity loss? Isn't food and water availability the primordial problem? Hence another educational challenge is to make the interconnectivity of processes and anthropogenic influence understandable. Just to give one example, many factors threaten biodiversity, not just activities that kill species directly, such as hunting, fishing, or pesticide use. Temperature and moisture changes associated with climate change may lead to habitat change and, eventually, habitat loss, which has a severe impact on biodiversity. Climate change also causes acidification in the oceans, again leading to biodiversity loss, for example, in coral reefs. Land-use change directly causes habitat loss but also has indirect effects: Using pristine land for agriculture may lead to overnutrification, which in turn may cause eutrophication of lakes and seas, that is, increasing amounts of nutrients such as nitrogen and phosphorus in the water, stimulating plant life and decreasing the oxygen content of the water, which in turn leads to biodiversity loss. And loss of forests, swamps, and organic rich soils due to land-use change causes loss of carbon sinks, again driving climate change, which in turn affects biodiversity.

While many people may be willing to accept the plausibility of the above examples, it is still more difficult to make clear that all activities in our sociospheres interact with the natural spheres and vice versa. Biodiversity changes and food production affect the natural spheres, but so does our entire economic system, our products and personal items, as well as our traffic systems, our science and cultural systems, ecosystems goods and services, our institutions, population, social organizations, and values and

attitudes. Our entire existence depends on the natural spheres, but also substantially alters them. Making the industrial and societal metabolism better understandable is a key challenge that our educational systems have rarely tackled so far.

There are also many examples which demonstrate that simple and—at first sight—probably convincing solutions might not be systematically well thought-out. An example is liquid biofuels. The idea of drawing down carbon dioxide from the atmosphere into plants and then using these plants to produce fuels, which are then burnt, producing energy and releasing carbon dioxide back to the atmosphere, appears logical. However, this fails to take into account many negative external factors: competition between food crops and fuel crops drives food prices up, while land-use changes such as deforestation, fuel production, and transportation release additional atmospheric carbon. In addition, the efficiency of liquid biofuels is very poor in comparison with fossil fuels, and even worse when compared with solar or wind energy. Aquaculture of carnivorous fishes is another example. It does not diminish but rather stimulates overfishing, since the production of one ton of top-level predatory fish uses many tons of other fish for feeding. Other examples with potentially large-scale negative side effects might be solar radiation management or fracking technologies in conjunction with carbon capture and storage.

Understanding Time-Related Issues

The temporal aspects of the Anthropocene are a particular challenge for education. The "Great Acceleration" since the 1950s gives us an opportunity to compare acceleration processes in natural spheres (for example atmospheric gases, ocean structure changes, or ecosystem changes) with societal accelerations (for example increases in overall GDP, direct investments, river damming, fertilizer usage, urban population, paper consumption, fast food restaurants, or telephone sales). It is also very important to discuss different timescales and how they interact with each other, such as cosmic, evolutionary, cultural, technological, societal, and individual timescales. Tropical shallow-water coral reefs, for instance, have actually died out and recovered multiple times during Earth's history, but recovery required many million years. So at a societal timescale it is no comfort to think that disappearing modern coral reefs might recover in the distant future, given their great economic and recreational value now.

Different timescales may also overlap: the present anthropogenic changes of the natural system are occurring in the lifetime of a single generation but may often have geological-scale effects. This is particularly true of climate change, biodiversity loss, and production of nuclear waste. Probably the most difficult topic is learning how to handle statistical certainties and uncertainties. Geologists can predict very well where large earthquakes could happen in the future; however, they are unable to predict the exact days or even the year of a large quake. Environmental problems are similar: it is not possible to predict tipping points, such as destabilization of ice sheets, collapse of the coral reef ecosystems, changes in ocean circulation, shifts in monsoonal systems, or the occurrence of hurricanes and regional droughts, in a very exact way. However, statistical likelihoods will increase and may be well predicted. Learning to live with anthropogenically changed statistical likelihoods but at the same time accepting that the cause of a single event, such as a hurricane, cannot be denoted as natural *or* anthropogenic, is a difficult educational task. The importance of the 2° C limit for global temperature increase might be explained in this way and may be helpful for understanding statistical scenarios.

Given the necessity of substantial, worldwide, and systematic changes in the behavior of humanity, how will they happen? Politics alone will not be able to institute the changes necessary to create a sustainable society. Various climate conferences and UN conventions have had little effect, for the agreements are not binding and many nations refuse to follow them. The failure of these summits has led to discouragement and mistrust of politics. At the same time, non-governmental organizations (NGOs) and protest movements also have little chance to significantly alter society or the economy without the support of large portions of the population.

The Role of Education in a Social Contract for a Great Transformation

One proposal for how to create such a sustainable society is outlined in a report by the German Advisory Council on Global Change (WBGU). A "Great Transformation" will require that individual states and the global community facilitate transformative processes through top-down regulations, whereas NGOs, innovative thinkers, visionary companies, and societal movements will play a bottom-up role as pioneers of change. But this is not enough; the crucial element for creating wide-scale change

is the existence of a societal transformation layer in which science, research, and technology work together with each other and the general public. This includes new dialogue and discursive formats, new forms of participation in politics and science, the development of best practice examples, platforms for forerunner companies, active involvement of dedicated public offices, the development of platforms for successful change agents, and finally ways of mainstreaming and routinizing these forms of dialogue (WBGU 2011, 2013). All this must be embedded in new forms of transformative and transdisciplinary education in order to allow the participation, discourse, reflection, and societal structures that are necessary for a transformation towards an Anthropocene that allows fair use and development chances for future generations. Such a knowledge-based transformation movement will therefore have to begin with new forms of education.

The 2011 WBGU report outlines several types of research and education required for accomplishing the Great Transformation. It distinguishes between "transformative" processes—that is, research and education directed towards finding concrete solutions to specific problems—and "transformation" processes—that is, research and education which focus on the larger contexts: how we have gotten where we are and what conditions are necessary for realizing the Great Transformation.

Transformative research and transformative education should support the active transformation process with specific innovations. Examples might be consumer research for new business models, developing more efficient technologies, and finding ways to distribute and encourage the use of new technological products. In other words, research in specific fields must be complemented by embedding it in the larger context. Transformative education must pick up this view and must cease to be treated as unidirectional knowledge transfer and instead be embedded in a culture of reflection and discussion. Transformation education, by contrast, focuses on factors and causal relations for transformation processes, on learning from history, as well as on the interaction between society, the Earth system, and technological development, and above all on human preconditions for change. It is especially this educational transformation aspect that the present article focuses on.

The structural challenges for an education towards societal fitness for designing a knowledge-based and livable Anthropocene can be summed up in one sentence: The

world is a complex, fundamentally interconnected system, while research and education focus on individual subjects considered in isolation. In nearly all countries, schools and universities compartmentalize education to a large degree, and discussions are mostly about whether to cut down one subject in favor of extending another one, rather than about introducing transdisciplinary fields such as climate change, biodiversity change, or the Anthropocene. In principle, European university education should be particularly suited to developing inter- and transdisciplinary curricula, for example, by using the freedom promised by the Bologna Process to recombine educational modules or add cross-disciplinary modules to existing courses. In practice, however, there are no proper incentives to facilitate interdisciplinary careers. Many European countries are developing interdisciplinary summer schools, interdisciplinary centers, and even entire scientific institutions dedicated to global analyses and solutions through inter- and transdisciplinary research. However, such efforts must be increased, and a better funding and success-measuring incentive system must be instituted, as well as more fluid structures allowing for systemic research on transformation topics.

Systemic, integrated thinking deals with the entirety of a situation and, following Ossimitz (2000) encompasses four central key elements: (1) interconnected thinking, (2) time-lapse, "dynamic" thinking, (3) thinking in models, and (4) system-compatible action. Introducing cross-disciplinary, integrated thinking into school curricula is of paramount importance and has the potential to renew traditional educational thinking (Ossimitz 2000; cf. Leinfelder 2013b). Such systemic, transdisciplinary thinking will be essential for school, university, and professional education as well as for life-long learning, in order to not only understand the complexity of the ecospheric-anthropospheric system (as described in WBGU 1993), but also to reflect, suggest, and initiate possible integrative options for action. This is crucial if we want to establish awareness of local and global responsibility and to foster integrated thinking in order to arrive at a comprehensive understanding of options for transformative action. It is thus a prerequisite for making the theoretical concept of a social contract for sustainability, as discussed above, become a reality.

Educational psychology, and in particular the still-young field of environmental psychology clearly shows that cognitive, rational reflection alone is not enough for learning, especially complex learning, to occur. Motivation is the key element (e.g., Pelletier et al. 1998; Pintrich 2003; Gormley 2011), and this is difficult, because in today's

society the Anthropocene must compete with the many other topics that clamor for our attention. Furthermore, there are no simple, easy solutions in the Anthropocene, and there may also be a sense of guilt for humans' role in creating the problem. As a result, it is particularly easy to make excuses or to choose comfortable arguments that relativize the problem, suggest that there is no urgency, or absolve the individual of personal responsibility.

In an ideal world, science and society should work together to produce knowledge and act upon it. The process would look something like the following: Researchers openly present their findings and explain the research process leading to these findings. They also candidly admit controversies and knowledge gaps. Then, scenarios based on the research findings are developed. They model future developments based on statistical likelihoods and assumptions about demographic development, the rate of technological innovation, and so forth. Using these models, options for actions are formulated. These can be suggested by special science-to-policy advisory bodies such as the WBGU, by citizens, or by politicians. Normally several options may be developed. Society, mostly in the form of political representatives, discusses the options and decides which options should be followed; the chosen option is then implemented.

However in the real world the process does not work this way. Often a great variety of personal motivations and economic and political interests stand in the way. These are often formulated as excuses.

- **The Relativization or Unreliability Excuse:** The presence of scientific controversy is interpreted as meaning that science is invalid and therefore preliminary research results can be ignored.

- **The Alarmism Excus**e: Critics choose to focus on particularly alarming scenarios and claim that such scenarios are exaggerated in order to support ulterior motives, such as receiving larger amounts of research funding.

- **The Missionary Excuse**: Using the reasoning above, possible solutions are dismissed out of hand based on claims that these actions are not necessary and that those proposing them actually just want to establish technocracies or eco-dictatorships, or brainwash society for their own purposes.

A more profound analysis of the arguments, strategies, motivations, and societal groups involved is beyond the scope of this paper, but it is important to note that motivations for science skepticism are not always driven by political or financial interests. Often, escapism and a desire to excuse oneself from responsibility may play a role. These attitudes may be encouraged by groups promising apparently simple solutions or arguing that there isn't a problem in the first place. In this respect, different kinds of science skeptics, such as evolution deniers and deniers of climate change or environmental change show similar traits. The problem is not so much these relatively small groups themselves, but their potential influence on rather large segments of society that may be driven to environmental skepticism because such a position is more comfortable than having to consider the "big picture" and the problems the world is facing, which would require changing one's own behavior. Other reasons for lack of personal involvement with environmental problems might include the belief that the effects of changing one's own behavior would be only minimal. Similarly, mistrust of others might lead to people choosing to continue to exploit, rather than preserve, common resources because they think others will act selfishly and take advantage of their altruistic behavior—the "Tragedy of the Commons." Finally, individuals might choose not to take any action because they are faced with multiple options and are unable to decide which one would be the best.

To sum up the "excuse game": three extreme and not at all science-based views of how the world of the future will develop are circulating, and they are not helpful for establishing individual and societal responsibility for taking care of an Anthropocenic world. These extreme, incompatible views are (in part following Zalasiewicz 2008):

- **The Trust-Future-Technology View**: Advances in technology will allow humans to completely engineer the planet, environment, and all living beings, essentially removing human society from natural cycles.

- **The Apocalyptic View**: We are well on the way to poisoning the entire planet and the ecological catastrophe is inevitable. Not only will organized society collapse, but all of humankind will probably die out in the near future.

- **The No-Problem View**: Human behavior is irrelevant because natural processes such as volcanoes and weather patterns are claimed to be stronger than any of the effects that human industry might have.

Not only are all of these views unrealistic and incorrect, but even worse, they are all fatalistic and therefore do not encourage action and change now. Even the first view allows rejection of present renewable energy technologies or present genetic engineering, because it appears better to wait for new technologies that would presumably cause less inconvenience for the individual; these might include proposals such as shading Earth in the atmosphere, creating artificial meat, or transporting all our nuclear and other waste to other planets.

How then, can people be motivated to make the changes necessary for the Great Transformation? One possibility is to look at how changes have happened in the past, both for inspiration that change is possible, as well as a source of models that may be applied to the present. This article will then highlight a number of projects currently underway to implement this societal transformation and encourage personal responsibilities and joint efforts, in part exemplified by projects with personal involvement of the author.

Learning from History

A very promising attempt to address the feeling that individuals and groups have of being overwhelmed by the magnitude of changes necessary for an Anthropocenic societal transformation is to highlight examples from the history of humankind that show ways in which long-lasting societal problems may be solved. According to the WBGU (2011), these lessons can be categorized into four types. First, *change by vision*, in which shifting values and ethical views lead to long-term alterations in society. These shifts may often be motivated by groups or individuals with visions of a better future, and gradually spread to the rest of society. The Enlightenment and abolition of slavery are possibly the best examples of how changing values and views, among other motivations, have resulted in one of the largest transformations of consciousness and society that we have ever had. Also important to state is that it took nearly the entire eighteenth century to implement Enlightenment, and that, astonishingly, abolition had not been a topic for the Enlightenment movement. Abolition took another 80 years, finally coming to a head during the secession war in the United States. The lessons from this are that change by vision is possible, that visions will have to be readjusted during the change process, and that implementation is a long and, in these examples, very violent pathway, with

revolutions and wars taking place. Given the fact that it took nearly 180 years for the implementation of the vision of equality, liberty, and justice, the 20 years between the first Rio environmental summit and the relative failure of the Rio +20 summit is quite a short period, given the enormous increase in environmental literacy and activism that has already been achieved in many parts of the world. The vision of an integrated European Union is another example of where visions came first and implementation is still not completed (and is even, at present, faced with considerable challenges).

Crisis may also be a powerful motivation for transformation. *Change by crisis* is unfortunately one of the most common forms of change. Catastrophes such as drought, floods, or famines create an urgent need to develop new solutions to problems that may have been ignored until that time. In 1815 the gigantic eruption of the Indonesian volcano Tambora resulted in a global temperature drop: 1816, also known as "the year without summer," was marked by very poor harvests and a significant increase in livestock mortality, leading to the most severe famines of the nineteenth century in the northern hemisphere. In Germany, King Wilhelm I of Württemberg founded the Experimental and Academic Institute of Agriculture at Hohenheim in 1818 as a reaction to this; his goal was to "radically improve" the food supply using scientific methods. To this day, the institute is still entirely dedicated to agricultural issues. The Green Revolution that started in the 1960s is another example of worldwide change triggered by crisis, as are Structural Adjustment Programs for developing countries.

In rare cases, improvements of scientific knowledge may lead to change before a crisis occurs, such as when new scientific insights allow researchers to identify problems or side-effects of existing practices that had not previously been suspected. Unfortunately, *change by scientific knowledge* is far more infrequent than it should be, for it requires not only that the scientific knowledge exists, but that policymakers can be convinced to act upon this knowledge. And far too often, we discover the consequences of our actions after it is already too late to easily fix. The best example is probably the ozone hole, which was identified in the 1970s along with the cause, chlorofluorocarbons (CFCs). Chlorofluorocarbons had been developed for a very good purpose: replacing dangerous fluids and gases in items such as refrigerants and fire extinguishers with non-toxic and non-explosive inert material. The reactivity of CFC in the atmospheric ozone layer was initially not known; scientists Paul Crutzen, Mario Molina, and Frank Sherwood Rowland warned in 1974 that the ozone layer would shrink and holes might

develop if the use of CFCs continued, research for which they later received the Nobel Prize. In consequence, CFCs were banned worldwide by the Montreal Protocol in 1987, in time to prevent the hole from growing to dangerous dimensions. Owing to the long "braking distance," the ozone hole is still not fully closed, but we are on the way to it. It is terrible to imagine what the consequences would have been if Paul Crutzen and his team had not discovered and loudly warned about the effects of CFCs!

Many other historical examples of societal or attitude change are a mixture of change by crisis and change by scientific knowledge. An example of this is the banning of DDT: although the scientific knowledge of the long-term effects of DDT was available earlier, it took Rachel Carson's book *Silent Spring* and her personal vision and action to highlight the dangerous effects of DDT on birds and other organisms and to initiate a movement against DDT.

Finally, technology is a trigger for transformations of all kinds, both positive and negative. *Change through technical innovation* is widespread and includes the mastery of fire and weapon-making in the Stone Age as well as agricultural methods for seeding, fertilizing, and watering that started in the Neolithic revolution. Another example is the perfection of the steam engine by James Watt in the nineteenth century, which was a key trigger for an avalanche of concurrent technical innovations and societal changes such as traffic and transportation, cloth and food production, and coal and iron mining and steel production. The IT revolution currently underway is another good example, with the spread of new communication systems even enabling revolutionary political changes, such as those presently occurring in Arab and North African countries.

It will probably require a combination of all these elements in order to bring about the changes needed for a long future of humans in a sustainable Anthropocene, with hopefully the crisis type not becoming the most important one. Science warns us that "braking distances" for many phenomena, such as climate change, rising sea levels, biodiversity loss, or contamination from nuclear waste, are of a geological timescale and not something that can be stopped or reversed within a few years.

Learning by Participation

Societal participation in research and the scientific monitoring of environmental or social change is crucial for teaching understanding of scientific procedures and scientific possibilities. This "citizen science" offers individuals insight into the challenges of the Anthropocene, as well as motivating personal action and change, producing individuals who then may serve as role models for others. Similarly, when options for action are being considered, citizen participation in the form of political and social discussion is needed to legitimize any decisions that are made. It is important to implement this early in people's lives, namely in school education (Eikel and de Haan 2007). Many polls and surveys indicate that individual and societal values are already fundamentally changing, but they also show the large gap between values and action, as well as the importance of factors such as worries about employment or economic growth for ranking priorities of values. Having the chance for discussion, discourse, reflection, and rethinking in participatory political processes or through new forms of more "liquid" democracies might be very helpful for achieving consensus on complicated issues such as the energy transition, transport systems, or land management.

Many best-practice examples exist. The Reef Check initiative (reefcheck.org) regularly assesses the state of coral reefs in a participatory manner, using data collected from around the world by volunteer scuba divers and reef scientists. Results are gathered in scientific databases, serve as the basis for scientific publications, and are an integral part of the survey reports of the Global Coral Reef Monitoring Network. These surveys are also a matter of debate for UN bodies. There are many other examples, mostly organized and performed by environmental NGOs, many of which focus largely on a specific species or ecosystem. Integrated and networked participative permanent anthrome monitoring stations on land are in a pilot phase. Schools, NGOs, natural history museums, other science institutions, and possibly public offices and companies could run such a monitoring network. Activities such as the early childhood science program Haus der kleinen Forscher, Junior Zoo University Berlin, or the youth science competition Jugend Forscht—all examples from Germany—should be further enlarged, networked, and funded. Traineeships and honorary lay researchers have become an integral part of personnel for science institutions such as natural history museums, and science slam and participative social media activities are growing. All have the potential to improve the integration of science into society. Programs for developing countries should also

enlarge the amount of participatory activities, since motivation, knowledge generation, and science legitimization may derive directly from the participatory science process.

Experiencing Scenarios and Debating Pathways

While large portions of society may have a fair amount of faith in science and research, they may lack such faith when it comes to scenarios and options for action. It is psychologically plausible that simple line-and-curve scenarios, such as those provided by the Intergovernmental Panel on Climate Change (IPCC), appear "artificial" or demotivating. It is hypothesized here that developing more understandable and emotional scenarios that speak not just to our rationality, but to "brain, heart, and hands," might help to make scenarios and options for change understandable and easier to discuss. In order to avoid the (understandable) reaction that "it's not possible to predict the future, just look at past predictions for the future," a strong participatory element may be helpful in this process.

Museum exhibitions can tell stories and narratives from past scenarios; they may also help to make abstract scenarios of future developments more imaginable by offering visitors hands-on, participatory experiences. Scenarios based on different choices or actions could be developed by external groups, and museum visitors might then decide in a participatory way what they find most likely, most feasible, or most appealing. The planned exhibition on the Anthropocene at the Deutsches Museum, which will be produced in close cooperation with the Rachel Carson Center, was originally initiated by the present author and will experiment with such new formats. Other successful examples under the responsibility of the author were arts-to-science projects such as the living Anthropocene diorama and the HUM art festival, both at the Museum of Natural History in Berlin, or the participatory short film festival on the occasion of a UN biodiversity meeting in Bonn (see Leinfelder 2012 for more details). Current large projects include the Anthropocene Project at the House of World Cultures in Berlin, which contains reflective and discursive formats such as dialogue forums, performances, and festivals to open minds for the necessary fusion of nature, culture, and technology by reflecting on key questions such as "is the Anthropocene beautiful, is it fair, is it human?" The Haus der Zukunft ("House of the Future") planned by the German government in Berlin, as well as many currently developed relaunches of

museums, including the upscaling of the Museum of Man and Nature in Munich, also address future-relevant topics and scenarios.

Pioneering: Starting the Change by Action

So far this paper has largely looked at the shortcomings, challenges, and requirements of an education enabling a societal transformation into a sustainable and long-lasting Anthropocene epoch. It has given some fundamentals, such as the role of participation, visualization, and new forms of reflection. This paper, however, should end with an appeal not to wait to transform education until top-down regulations have been changed, but rather to stimulate pioneering activities. Such change agents might be the only ones who can mainstream new and necessary developments, and by doing so also help politics to establish new frameworks and rules for educational transformation. I will briefly list some current activities that might fall into this category.

Integrated education across disciplinary boundaries
In a small research project we tested whether complex, Anthropocene-relevant topics such as the ozone hole, biodiversity issues, or even the Anthropocene concept itself can be taught under existing school curricula in an integrative manner (Poch 2012). We experimented with experimental modules bringing these topics in a concurrent, complementary fashion into school subjects such as chemistry, biology, physics, mathematics, geography, social studies, economics, and the arts. We checked with the official state of Berlin school curriculum for compatibility and evaluated the success through polls with students and teachers. Our findings were that such interdisciplinary teaching can already be implemented without incompatibilities with existing official school curricula, although new materials for supporting teachers would be highly welcome, and officially introducing a matrix curriculum structure that allows both traditional subject-specific teaching (vertical elements) cross-cut with transdisciplinary teaching (horizontal elements) would improve conditions for presenting complex topics.

Introducing integrative modules into university teaching
Similarly, at least in the majority of countries, university subjects are still largely taught in isolation, as pointed out above (WBGU 2011, chap. 8; Leinfelder 2011). Implementing new courses, interdisciplinary modules, or entire institutions in order to teach and

research transformation and transformative issues requires substantial bureaucratic and structural changes that will take time; however, first steps may be taken even before such a transformation process is completed. The personal experience of the author is that many fields can already integrate key concepts of the Anthropocene into existing modules; for example, in geology, topics such as Earth history, geo-ecology, coral reefs, or ocean processes are highly relevant. Even field courses can be performed this way: an experimental course that I taught at the Freie Universität Berlin in 2012, "The Anthropocene of Berlin and Its Vicinity," fusing geology, geography, and the cultural, social, and technical development of the region, turned out to be very successful. Similar joint projects are certainly possible in other subjects, such as biology, design studies, and the cultural, social, and political sciences. The German Advisory Council on Global Change (WBGU) has provided a free-of-charge online lecture video seminar on the Great Transformation that offers ideas for adding transformative and "Anthropocenic" elements to one's own lectures (wit.va-bne.de).

Introducing new communication formats

Whereas the WBGU lecture series is designed for university teaching, another format has been developed by the author's working group with the aim to "translate" the WBGU flagship advisory report on the Great Transformation to secondary schools and a still wider audience. The essentials of the reports have been converted into a comic book, with WBGU members being shown in their personal working environment and speaking—in speech bubbles, but in a normal language—about the challenges and solutions for the future of the planet, with a particular focus on climate and energy issues, although not limited to these concerns (Hamann et al. 2013). The comic book has received broad media interest and is part of a research project evaluating the potential of this format for communicating complex environmental and societal issues, as well as its potential for aiding transdisciplinary school teaching (Leinfelder 2013a; cf. die-grosse-transformation.de). The book tries to demonstrate that, apart from the need for new political and legal regulations and financing options, there are sufficient technical and societal options available for creating a sustainable future, both short-term and long-term; however, the most important factor is taking on personal responsibility and starting with personal action for change.

Personal everyday action

Personal action is certainly one of the most important forces driving a new education for the Anthropocene. Direct activities, such as upcycling fashion, car sharing, repair cafés, or urban gardening, to name but a few, can go along with making different lifestyle choices, such as changes in personal consumption patterns, e.g., choosing products with a long life cycles, following certification systems and ecological footprint indications, or not using plastic bags. Not only can this make a difference in energy and resource consumption, but it may also encourage others to follow one's own example, especially if individuals talk about their activities in social networks and blogs and among friends and local groups. Facebook or Twitter could be even models for how to rapidly spread and implement new ideas, making pioneering efforts into everyday routines. And why not experiment with new eating styles, such as trying insect food, algae, and so forth? Certainly, the new Anthropocene must also be sustained by positive actions of those who are willing to change in a creative, curious, playful, open-minded, and responsible way and inspire others to do so as well. Learning by doing might sound old-fashioned, but it is probably still the best way to start a Great Transformation to a long-lasting Anthropocene in which humanity and its actions are an integral and compatible part of nature.

Conclusion: Educational Ethics

Societal transformation towards a sustainable Anthropocene implies ethically relevant consequences for individual and societal thinking, lifestyles, and actions. All this must be based on available knowledge together with personal experience, reflected normative thinking, and personal well-being. Learning for the Anthropocene is therefore one of the most important prerequisites. Learning must be lifelong, creative, and motivating, as well as helping individuals to understand complex interconnected problems and preparing them for a world full of uncertainties and a lifestyle compatible with planetary and societal—hence Anthropocenic—boundaries. Such learning must be set up in a comprehensive and transdisciplinary fashion and must focus on acquiring practical, applicable knowledge and skills, rather than merely imparting facts. Personal perception of one's own and society's interdependence with the Earth system may be best achieved by participative learning and experimental model projects. The aim is also to encourage reflection about personal consumption behavior. Priorities and status symbols should

be reconsidered. What does it mean to be "cool"? Can we learn where and under which constellations our "archaic reflexes"—aggression, selfishness, defense, or escape—tend to dominate? How much do social norms dominate our behavior? Why do we feel so comfortable in groups and often instinctively adopt the standards of these groups? How important are deviations from the mainstream? Do these lead to the formation of new groups? Can all this be reflected in one's personal curriculum and can it be used positively in terms of competence for sustainability? All new forms of education must tackle the question of whether and how we might reach a global ethos characterized by behavior patterns that are environmentally sustainable, fit for the future, and fair for future generations as well as our own. The ultimate aim would be to make understandable that each individual and each societal group determines the nature of globalization through their own actions. In this way, and with all the cultural and societal diversity we have on this planet, everyone is a member of a "glocal world society."

The Anthropocene concept appears particularly useful also for educational purposes, since it uses metaphors, integrates disciplinary knowledge, promotes integrative thinking, and focuses on the long-term perspective and with it our responsibility for the future. It thus includes broad ethical aspects that do not instrumentalize the Anthropocene for political motives but rather emphasize the open, pluralistic search process on the road to sustainability. This integrative, knowledge- and systems-based thinking is the only way to define essential ethically justifiable normative basics that may be summarized as follows:

The dualistic view of (good) nature opposing (an essentially "bad") humanity, including human culture and technology, cannot be further maintained in the face of the degree of anthropogenic influence on the Earth system. Humans must regard themselves as an integral part of today's (neo-)nature. Human economies and other activities must become compatible with nature, which implies that every individual thus automatically shares responsibility in this regard. Furthermore, the way back to the Holocene is neither possible nor ethically desirable. This implies that our behavior and action must be intra- and intergenerationally compatible. Finally, the path towards a sustainable Anthropocene is not an easy one, and it can only be followed by applying comprehensive and thoughtful integrative solutions. Knowledge-based sustainable "gardening" must supersede the prevailing overexploitation of nature; it should also form a reflexive basis for personal behavior.

Thus education for the Anthropocene has at its core an ecological humanity that emphasizes the freedom and dignity of the individual. Like scouts, every member of society is involved in the process of finding, trying out, discussing, and evaluating different paths towards a sustainable and long-lasting Anthropocene, thus assuming responsibility for this new and challenging geological epoch.

References

Crutzen, Paul J. 2002. "Geology of Mankind." *Nature* 415: 23.

Crutzen, Paul J. and Eugene F. Stoermer. 2000. "The 'Anthropocene.'" *Global Change Newsletter* 41: 17–18.

Eikel, Angelika and Gerhard de Haan. 2007. *Demokratische Partizipation in der Schule: Ermöglichen, fördern, umsetzen*. Schwalbach: Wochenschau-Verlag.

Gormley, William T. 2011. "From Science to Policy in Early Childhood Education." *Science* 333: 978–81.

Hamann, Alexandra, Claudia Zea-Schmidt, and Reinhold Leinfelder, eds. 2013. *Die Große Transformation: Graphic Interviews mit dem WBGU*. Illustrations by Jörg Hartmann, Jörg Hülsmann, Robert Nippoldt, et al. Berlin: Verlag Jacoby & Stuart.

Leinfelder, Reinhold. 2011. "Von der Umweltforschung zur Unsweltforschung." *Frankfurter Allgemeine Zeitung*, 12 October: Forschung und Lehre N5.

———. 2012. "Darwin, Biodiversität und dann?" *Natur im Museum: Mitteilungen der Fachgruppe Naturwissenschaftliche Museen im Deutschen Museumsbund* 2: 58–72.

———. 2013a. "Editorial: Neue Wege—WBGU-Gutachten als Comic." *Biologie in unserer Zeit* 43 (3): 135–36. doi: 10.1002/biuz.201390046.

———. 2013b. "Verantwortung für das Anthropozän übernehmen: Ein Auftrag für neuartige Bildungskonzepte." In *Wo steht die Umweltethik? Argumentationsmuster im Wandel*, edited by Markus Vogt, Jochen Ostheimer, and Frank Uekötter. Marburg: Metropolis Verlag, in press.

Leinfelder, Reinhold, Christian Schwägerl, Nina Möllers, and Helmuth Trischler. 2012. "Die menschengemachte Erde: Das Anthropozän sprengt die Grenzen von Natur, Kultur und Technik." *Kultur & Technik* 2012, no. 2: 12–17.

Ossimitz, Günther. 2000. *Entwicklung systemischen Denkens.* Munich: Profil-Verlag.

Pelletier, Luc G., Kim M. Tuson, Isabelle Green-Demers, Kimberley Noels, and Ann M. Beaton. 1998. "Why are You Doing Things for the Environment? The Motivation Toward the Environment Scale (MTES)." *Journal of Applied Social Psychology* 28: 437–68.

Pintrich, Paul R. 2003. "A Motivational Science Perspective on the Role of Student Motivation in Learning and Teaching Contexts." *Journal of Educational Psychology* 95: 667–86.

Poch, Anneli. 2012. "Das Anthropozän-Konzept—Wie kann systemische Bildung in den Unterricht integriert werden." Unpublished master's thesis, Institut für Biologie, Humboldt-Universität zu Berlin.

Rockström, Johan, et al. 2009. "A Safe Operating Space for Humanity." *Nature* 461: 472–75.

WBGU [German Advisory Council on Global Change]. 1993. *World in Transition—Basic Structure of Global People-Environment Interactions.* Bonn: Economia.

———. 2011. *World in Transition: A Social Contract for Sustainability.* Berlin.

———. 2013. *World in Transition: Governing the Marine Heritage.* Berlin.

Wilkinson, Bruce. 2005. "Humans as Geologic Agents: A Deep Time Perspective." *Geology* 33: 161–64.

Williams, Mark, Jan Zalasiewicz, Alan Haywood, and Michael Ellis, eds. 2011. *Philosophical Transactions of the Royal Society A* 369, Special issue, "The Anthropocene: A New Epoch of Geological Time?"

Zalasiewicz, Jan. 2008. *The Earth after Us: The Legacy that Humans Will Leave in the Rocks.* Oxford and New York: Oxford University Press.

Christian Schwägerl

Neurogeology: The Anthropocene's Inspirational Power

The Anthropocene concept captures the realization that humanity is interfering, interacting, and communicating with the Earth's long-term systems with increasing intensity. What happens to Earth could be called anthropoization. This is a new phase for the planet and a new experience for us as a species. In the Pleistocene, when modern humans evolved, they were hunters and gatherers exposed mainly passively to the powers of the Earth. In the Holocene, when humans started farming, building cities, mining, and fishing, they exploited a natural treasure trove that had built up over 4.5 billion years without considering the effects of their actions. The Holocene was the stage for a human rebellion against natural limits. It was a successful rebellion.

Now, in the dawning Anthropocene, it looks as if the future Earth will be dominated by human action (unless, as Paul Crutzen has stated in his seminal article "Geology of Mankind" in *Nature* magazine, "there is a global catastrophe—a meteorite impact, a world war, or a pandemic"). In addition, the anthropogenic changes will feed back on humans and how they perceive the world.

Planet Earth is going through a "human bottleneck." Basically all of the Earth's surface, large parts of the oceans, and even considerable parts of its crust are affected by human actions. These actions change key parameters of its geological, biological, and chemical composition and character. The planet has entered a period of what should be called "neurogeology": the mental states and resulting actions of individual humans, groups of humans, and the collective mental states of all humans together are creating a new mode of planetary development that blends human infrastructure and technology with novel ecosystems, a higher chemical and geological diversity, an altered climate, and even entirely new life-forms.

Even single individuals can have immense neurogeological power, as seen in the example of Thomas Midgley, who invented CFC cooling substances that later depleted the ozone layer, the result of two billion years of photosynthesis. He had, as environmental historian John McNeill wrote in his book *Something New Under the Sun: An Environmental History of the Twentieth-Century World*, "more impact on the atmosphere than

any other single organism in Earth's history." Another example is Fritz Haber, who together with Robert Bosch developed a way to turn atmospheric nitrogen into fertilizer, increasing food production and with it the human population, as well as altering the chemical composition of soils and the oceans.

In the Anthropocene, the future fossil record and the long-term composition of the biological world will be strongly determined by human action (and inaction). Geologist Jan Zalasiewicz pointed out at the opening of "The Anthropocene Project" in Berlin in January 2013 that there are at least 100,000 domesticated cats in the world for every tiger in the wild. This leads to the perspective that in the long run, new species of wild felines could potentially evolve from today's housecats. Directed evolution, shaped by the tastes of early Anthropocene pet owners, may procreate neo-wild species of the future and their even more distant fossil remains.

An Anthropocene age with a neurogeological character still sounds like a deliberate provocation to many, as it greatly emphasizes human action and joins the most short-term, seemingly ephemeral processes in human brains with the most long-term forces of geology. This goes against both our intuition and long-held concepts of a nature-culture dualism. Scientists' reluctance to confront this new world is reflected in the fact that 75 percent of biological research stations are crammed into 25 percent of land surface, namely those few remaining areas with little human impact, as Emma Marris has pointed out in her book *Rambunctious Garden.* The man-made landscapes are taboo for many biologists because they are "disturbed" by human activity—a rather misanthropic notion. Another example is the reluctance of mineralogists to accept man-made crystals—like those in ball-point pens—as worthy of study and classification.

But once you open your scientific and personal eyes and minds for the Anthropocene challenge, the world is already full of neurogeological phenomena, as Zalasiewicz and others have made clear in their research. The Anthropocene concept creates a single continuum that stretches from stones to human thought, from the most concrete and enduring phenomena to the most abstract and fleeting, effectively dissolving the artificial dichotomy between "nature" and "culture" that has for so long hindered a more symbiotic development between civilization and the overwhelming majority of the eight million or so other species on Earth. Beyond dualism, a world of neurogeological and biocultural amalgams, hybrids, emulsions, and fusions is waiting to be discovered, described, explored, and experienced.

For those who are skeptical about the Anthropocene concept, it might be reassuring to emphasize that first and foremost, it is only one of many scientific hypotheses. The claim that humanity's collective action is forceful enough to show up in the geological record is being tested by scientists today and will be tested further over the millennia to come. A working group under the umbrella of the International Commission on Stratigraphy has been formed to carry out the necessary research. A first scientific verdict by this group is expected for 2017, but later geologists, in the year 2700 or 27,000 (or 270,000), will continue to assess mankind's geo-power and weigh it against the criteria for dividing Earth's history into distinct pieces of time. This will lead to a series of ongoing judgments and classifications.

According to this purely scientific, analytical understanding of the Anthropocene, the concept does not contain any normative, ethical, or philosophical implications. The deciding criteria is whether it is possible to distinguish a "golden spike," a distinct and measurable signal of human presence in the geological record that remains for an extremely long time span. In this view, it does not matter what particular actions we take—whether all humans become carbon-neutral vegans or whether we decide to burn the last piece of coal. One might even consider helping future geologists by bringing about particularly significant changes in the Earth system, such as runaway climate change or a huge wave of species extinctions, because that makes the task of delineating the current epoch from the Holocene much easier. Breaking up the landscape and the underground terrain with the help of "fracking" technology, as is being done in the latest energy revolution in the United States, is another example of how it has been made easier for geologists to determine the onset of the Anthropocene. But it would be rather cynical to approach the issue at hand like this. Luckily, hardly anyone views the Anthropocene concept in such a way.

Without a larger and deeper meaning, the Anthropocene idea would probably not have attracted so much attention and debate. The reason why the concept is so attractive is its usefulness as an introspective and interactive tool: by offering a name for the totality of human-Earth interactions and for a potentially long future of humans on Earth, the Anthropocene concept takes the shape of a new framework to think about ourselves as individuals and as a collective. On a phenomenological level, it reflects a progression: while humans once made regional and short-term changes to the environment, the changes are now global and long-term. On a more ontological level, it stands for the

expansion of our environmental consciousness from our immediate vicinity to the entire globe, and of our predictive scientific power from isolated laboratory experiments to the behavior of global biogeochemical systems. There is also a strong temporal aspect: the Anthropocene idea extends the traditional "short now" (ranging from single moments to the duration of an individual life) to a "long now" that includes the effects of our daily lives of today on the centuries, millennia, and actual millions of years to come.

One very strong metaphorical message that seems to come out of the Anthropocene idea is that it attributes to humans a rightful place on Earth and a deep embeddedness in Earth history. When people are first confronted with the Anthropocene idea, a typical reaction is that they think it is the sum of all environmental problems, short for everything that goes wrong and for the alienated and actually alien status of humans within a perceived "natural world." On closer examination, the Anthropocene idea does the opposite: it firmly links humans with everything that goes on around them and integrates humans into what used to be called the natural world. We start to see the link between natural phenomena and the man-made, like the work of past organisms that have created the limestone used in our cities or the contribution of bacteria billions of years ago to produce the ores that we use to build our machines and skyscrapers. We also start to see the man-made in the natural when we accept the biodiversity brought about by cultivating plants, animals, and bacteria, and when we observe how the millions of tons of man-made machines become parts of the biomaterial cycle through decomposition.

A future science of neurogeology can explore how we will meet ourselves in the nature of the future and what this does to us. Humans will shape nature in ways that have rather scary real-world consequences, like superstorms caused by anthropogenic emissions of greenhouse gases or poisoned ecosystems resulting from the accumulation of toxic waste. Human action will be embedded even in orchids deep in the rainforest because the plants grow using carbon atoms that have already gone through coal-fired power plants. At the same time, more beautiful processes become possible, like increased knowledge from long-term remote sensing and global monitoring. This could pave the way for an expansion of our global consciousness and for more introspective insight into our fateful connection with the dynamic changes in climate and biological systems.

Despite these opportunities, there is still a lot of skepticism about whether the Anthropocene idea is valid and useful. That is understandable and healthy. Accepting

the Anthropocene concept prematurely, that is, before proper scientific assessment or because it is a new and fashionable term that delivers us from the boredom of repeating "sustainability," would not be helpful for its long-term evolution. It is important that the Anthropocene idea is developed with a sound grounding in science and with contributions from many perspectives. There are a multitude of viewpoints.

Old-school geologists (or rather their stereotypical representatives) might be suspicious that the Anthropocene theory ignores the retrospective and deep-time character of the traditional stratigraphic classification system. They might even be alarmed by this strange intrusion of ephemera-producing culture on the geological record. A stereotypical biologist might feel uncomfortable with what seems to be an overemphasis on human action within the Earth's flow of matter and genetic information. A humanities scholar might see a dangerous attempt to create a naturalistic world order as an extension of technocratic concepts of Western-style progress. An ethicist could ask whether experts on stones and soils now want to study and even set human social norms instead of the disciplines and institutions that are traditionally responsible for doing this. Historians could easily see an expropriation of their home turf, as human history is suddenly absorbed into the larger picture of Earth history with its own and different mechanisms and contexts. Indigenous people might feel that their very different view of humans and nature is being forcefully taken over by a universalistic concept created by white, male natural scientists from Western cities that declares all other perspectives to be "pre-Anthropocene," that is, outdated or outright primitive. An old-school environmentalist might view the Anthropocene idea as an attempt to justify and rationalize the triumph of industrial destruction with pseudo-harmonic rhetoric. Someone who believes in a superior creator, a.k.a. God, will be upset by the hubris of the human determination to engineer Earth that emerges when the Anthropocene and anthropocentrism are seen as one. From this perspective, the Anthropocene might just be a reenactment of the Tower of Babel story. And finally, a politician might dislike the Anthropocene because it imposes a long-term temporal pattern that is hard to reconcile with the four- or five-year rhythm of Western democracies.

But conversely, for the very same mix of people, the Anthropocene concept might turn out to be a very useful and inspiring tool for reconsidering, developing, or modernizing their ingrained perceptions.

Old-school geologists (or again, their stereotypical representative) can revisit the criteria upon which their discipline is based and expand their ideas about whether Earth history has entered into a new phase with new rules that deserves new criteria. The biologist can start to research new emerging entities of biocultural nature, entities that merge the molecular and the cultural sphere, that have so far escaped deeper study and are hidden in the continuum from soil to thought. Humanities scholars might be tempted to work on extending their interpretational power into the organic-material sphere. An ethicist could look into the novelty of a world of man-made natural causes and effects and explore whether these phenomena merit the creation of new rules for living together. A historian could use the Anthropocene concept as a lens to revisit past events in terms of their relevance for the emerging world and as an empty signifier for the future of history and the history of the future alike. Indigenous people could rightly claim a place in the Anthropocene pluriverse, where their values and ideas are treated as contemporary instead of old-fashioned. An environmentalist might use the concept to escape from the paradox of shifting reference points in the past, depart from the retrograde nineteenth-century nostalgia embedded in many eco-strategies, break through the "apocalyptic wall" of doomsday forecasts, and jump out of the tragic narrative of environmentalism. All this could empower us to shape and frame the future instead of clinging to an idealized past. A Christian believer or scholar could use the Anthropocene as a metaphor for a time in which the biblical mission of "subduing" the Earth has been nearly completed, posing questions about what to do next. And finally, a politician might use the concept as a tool to argue against and perhaps overcome the "egotism of the present" that is so characteristic of many policies, from financial regulation to pension policies to environmental management.

Developing the Anthropocene idea need not be a linear or elitist process in which a body of canonical texts arises and a small elite of specialized scholars defines what this Age of Humans is about and what it is not. In contrast, the Anthropocene is a platform open to anyone to join in the debate and reflection. It is a privilege for all humanity that the Anthropocene is becoming a "process that reflects about itself" (Jürgen Renn). Therefore, rolling out the idea globally must be a very democratic and open-source undertaking that is continually revised and adapted. Inevitably, the neuro-geological future of Earth will be shaped by the sum of the mental states of all its citizens, including a wide range of desires and motivations such as existential needs, greed, egotism, common dreams,

evil intentions, beautiful aspirations, and short-sightedness, as well as prescient and attentive attitudes. However, it will be much more difficult to find a way to invite all humans into the Anthropocene arena and make them conscious members of a planetary polis. Due to rapid urbanization and the extension of the "invisible city" (the extensive infrastructure of farming, mining, and extraction of fossil fuels needed to sustain city life), this polis seems an inevitable necessity, but one that is hard to achieve.

In this context it is important to focus on the first part of the word "Anthropocene." While the concept initially gives the impression of a grand and encompassing term, it also allows us to connect individual everyday lives to global changes. Every human being can be seen and can see himself or herself as an Anthropocene protagonist. When Australian zoologist Tim Flannery describes humanity as a "mammalian super-organism" in his book *Here on Earth,* he does not equate humans with pre-programmed ants. Instead, this super-organism consists of billions of beings, each with a very high emotional, creative, and intellectual potential, given the right conditions to develop it.

This is important, as entering the Anthropocene means entering a phase in which the planet is permeated with human intentionality. Until recently, CO_2 emissions were a blind collective process; however, since the reports of the Intergovernmental Panel on Climate Change (IPCC), the story is different. Humanity continues to change the climate without a plan, but at least now we are aware of what driving cars, flying planes, and consuming energy-intensive goods will lead to. In the future, climate models will tell us with increasing clarity what the effects of our personal and collective emissions are. Very soon, then, we will no longer be able to excuse ourselves by pleading a lack of knowledge. What emerges is a new imperative to end the inadvertent side-effects and start making our interactions intentional, as Julia Pongratz, a researcher at the Max Planck Institute for Meteorology in Hamburg, noted in a talk for "The Anthropocene Project" in Berlin in 2012. We have to move from behaving like a bull in a china shop to curating the planet as a collection of priceless artworks. This is a tricky task, as a lot of the changes we perform are of such a long-term nature that it is difficult to assess the pros and cons. Climate change, for example, threatens the coming generations, but in the long run might stop the Earth from entering another ice age. Biotechnology might be monopolized by very problematic companies at the moment, but at the same time it open up new possibilities for enriching the planet with man-made biodiversity.

What is happening is a shift of intentionality and responsibility from the "short now" to a "long now." This challenges political institutions to develop forms of representation for non-human agents and for the interests of future inhabitants of the Earth. The debate about this expansion of democracy has only just begun. The same is true about most other aspects of the Anthropocene. Given the average "lifespan" of ten million years for any given species on Earth, we humans are incredibly new on Earth, as if we have just arrived. The Anthropocene is but a moment on the geological scale so far. Therefore it can be seen as a wide-open opportunity to fill the world not only with sensors, but also with sense.

The Anthropocene tells us how deeply interwoven the geosphere, the biosphere, and the emerging noosphere are becoming. Future neurogeologists will coin new terms to describe the patterns and mechanisms of this process. What is important to note is that modern life doesn't separate us humans from "nature." On the contrary: the more we interfere with resources and ecosystems, the closer we get to natural phenomena and the deeper we move "into" the new nature that arises through our actions. When we start to see past living organisms in the products that surround us as urban dwellers; when we start thinking about the 40 mountains hidden in the components of any given smartphone; when we become aware of the gargantuan effects that the past two hundred years of modern life have had upon our world: then we might start to question our current priorities, our sense of time and place, our attitude towards our co-inhabitants of Earth and our daily material communication with the billions of future human beings who will inhabit the Middle or Late Anthropocene. When we start seeing ourselves not as the masters of the planet, but as the primordial humans of the future, we might be able to escape hubris and strengthen our sense of humility. While previous epoch names played no role for our everyday lives, this is different in the Anthropocene. It is an epoch that is about everyone, concerns everyone, and belongs to everyone. That is what gives it such enormous inspirational power.

References

Crutzen, Paul J. 2002. "Geology of Mankind." *Nature* 415: 23.

Flannery, Tim. 2010. *Here on Earth: A Natural History of the Planet.* New York: Atlantic Monthly Press.

Marris, Emma. 2011. *Rambunctious Garden: Saving Nature in a Post-Wild World.* New York: Bloomsbury.

McNeill, John R. 2000. *Something New under the Sun: An Environmental History of the Twentieth-Century World.* New York: Norton.

Jens Kersten

The Enjoyment of Complexity: A New Political Anthropology for the Anthropocene?

The concept of the Anthropocene calls for a new political anthropology that focuses on human enjoyment of a complex world. The global scale of human influence on the environment means that we are embedded in various social, economic, and—especially—ecological contexts that are inseparably connected. Therefore, as I will show, even though the Anthropocene originated as a geological description of a new Earth period, it is by necessity an ethical and normative reflexive concept as well. Depending on what framework of political anthropology is used, the ethical and normative aspects of the Anthropocene can be considered either in an institutional or in a conflict model. With reference to these two models, I will finally show why a paradigm change in political anthropology—from the *Homo sapiens pauper* of Hobbes to the *Homo sapiens luxus* of Sloterdijk—might be reasonable and realistic as a way of establishing dams against human self-destruction in the Anthropocene.

The Anthropocene Concept

Alteration of biochemical and water cycles, losses of biodiversity, climate change, and the transformation of landscapes are the characteristics of the Anthropocene, which developed—according to Paul Crutzen, Jacques Grinevald, John McNeill, und Will Steffen—in three steps (Steffen et al. 2011): It began with industrialization, and so its first period lasted, in their view, from 1800 to the end of World War II. After 1945, the Anthropocene entered its second stage: "The Great Acceleration," which continues through the year 2000 and into the twenty-first century. In this second step of the Anthropocene, population growth, urbanization, infrastructure development, escalation of consumption, and the development of genetic engineering and synthetic biology go hand in hand with the global collapse of ecosystems, global exploitation of resources, global cutbacks on biodiversity, and—of course—global warming. The third stage of the Anthropocene begins in the present as a period of "growing awareness of human impact on the environment at the global scale and the first attempts to build global governance systems to manage humanity's relationship with the Earth System." But Crutzen and his

colleagues have doubts concerning this third period; the failure and disappointments of global governance of climate and biodiversity leave them with the same question which they started with: "Can human activity really be significant enough to drive the Earth into a new geological epoch?" And in their answer to this question, Crutzen and his colleagues compare Darwin's understanding of evolution to their perception of the Anthropocene: "Darwin's insight into our origins provoked outrage, anger and disbelief but did not threaten the material existence of the society of the time. The ultimate drivers of the Anthropocene, on the other hand, if they continue unabated through this century, may well threaten the viability of contemporary civilization and perhaps even the future existence of *Homo sapiens*" (Steffen et al. 2011, 862).

This reasoning shows that the Anthropocene is obviously different from other labels for geological Earth periods. "There is"—according to Joachim Radkau (2011, 28)—"no greater risk than categorizing the present epoch." Geological ages have all gotten their names retrospectively, and they are—in many cases—named after extinct species found in the fossil record during that period. The Anthropocene is obviously different: It is a "history of the present," and mankind is not extinct—yet. But if one follows the argument of Crutzen and his colleagues carefully, for them the Anthropocene is not a mere geological classification. They speak about an "Anthropocene concept" (Steffen et al. 2011, 843). This "Anthropocene concept" does not simply name geological facts, but is shaped by politics and governance. This conceptual framing is—at least in my view—a meaningful approach to understanding the Anthropocene, which refers back to the role of humans in the Earth system at every level. Firstly, the Anthropocene is the Earth time of humans ("Menschenzeit") (Schwägerl 2012, 9–54; Crutzen and Schwägerl 2011). Secondly, the Anthropocene describes a space dominated by humans: Humans see and shape the Earth as "their" world ("Menschenwelt") (Reichholf 2008, 105). An inspiring pamphlet captures this new, claustrophobic spatial self-understanding of humanity in stating that the "spaceship Earth has no emergency exit" (Crutzen et. al. 2011). Thirdly, the central actor in the Anthropocene is humanity, which is altering the Earth's ecosystems with dramatic consequences for the environment that humans need for their own survival. And fourthly, the concept itself is a product of human thought and reflection: Who else is able to name, describe, and manage this new Earth period, if not human science?

These four dimensions—time, space, action, and science—explain why the Anthropocene is necessarily different from classical geological classifications and why the

Anthropocene concept is not only about facts, but automatically about ethics and laws; not only about science, but automatically about politics and governance. Involvement results in responsibility. Christian Schwägerl (2012, 358) has aptly formulated this normative requirement in the maxim that no individual and no society should behave as if they were the last to live on this planet. This advice already implies the idea of an Anthropocenic Enlightenment (WBGU 2011, 84–85), in which a green Immanuel Kant might formulate the new categorical imperative of the Anthropocene: "Live your life in such a way that it can be made universal in a globalized world in which there is no longer a clear distinction between nature and culture." The concept of the Anthropocene not only recombines facts and ethics, but also constitutes a framework for an interdisciplinary scientific understanding of a new relationship between nature and culture. The Anthropocene can tell us something about the very complex ecological, social, and technical development of our Earth time and its cultural perceptions, with their consequences for our present understanding of art, biology, chemistry, diet, ecology, economy, education, ethics, geology, media, politics, science, society, technology, and—last but not least—law.

To summarize, the Anthropocene incorporates interdisciplinary scientific analysis and evaluation of the human impact on global biology, geology, and ecology, which are thus inseparably connected with cultural developments. Against this background we can focus now on the question of how this concept of the Anthropocene changes our views on political anthropology.

Homo sapiens pauper

Political anthropology addresses the fundamental question about the nature of human beings and the logical implications our answers have for society and politics. Many approaches in political anthropology try to create the impression that determining human nature is an act of self-evident insight or even pure scientific deduction. But of course this is not true: Political anthropology is a normative construction through and through. And the norms that are chosen will depend upon what assumptions are made about the sort of creature that human beings are. The discussion in this paper will start with the view of a "*Homo pauper*" (Sloterdijk 2004, 702), humans as "poor creatures," as formulated by Hobbes, who proclaims that the "life of man" in its natural status is

"solitary, poore, nasty, brutish, and short" (Hobbes [1651] 1985, 186). Certainly there are more positive characterizations of humans in political theory. But this formulation in its provocativeness has been enormously influential and can be seen today in the political and economic institutions of our globalized world.

The social implications of Hobbes's theory are, in simplified form, as follows: The original poverty and powerlessness of humanity in its natural state leads to us to be selfish. It is a struggle for survival in which everyone is at war with everyone else. Out of their selfish passion for a good life and their fear of being killed, humans create their most powerful institution—the state—through contract as a way of protecting their own self-interest (Hobbes [1651] 1985, 183–228). But this picture of the *Homo sapiens pauper* has consequences not only for the creation of political institutions, but also for the relationship between humans and nature—a relationship that is not yet regulated by a social or a social-ecological contract. There is no mutual agreement to protect or conserve natural resources for future generations; nature is there to be used and exploited for our own immediate, personal needs. Max Weber has pinpointed the consequences of this approach in his famous prediction that the current economic system will come to an end on the very day "when the last ton of ore has been smelted with the last ton of coal" (Sombart 1928, 1010) or—as Peter Sloterdijk ([2009] 2013, 367) adds—when the last barrel of oil has been used up by driving SUVs through the suburban jungle.

As a consequence, some scientists and policymakers have taken up this classical idea of the social contract to develop an institutional model for the Anthropocene.

A Global Social Contract for Sustainability?

One such model is outlined in a report published by the German Advisory Council on Global Change (WBGU) in 2011. This "Social Contract for Sustainability" aims to tackle the global environmental challenges of the Anthropocene, in particular climate, energy, and natural resources. The report calls for a "Great Transformation" that will result in "a low-carbon and sustainable global economic system" (WBGU 2011, 1; Leggewie and Welzer 2011, 174–230). The proposal for a global social contract is founded on the idea that all of us—whether private individuals, states, or industries—are jointly responsible for preventing climate change and other changes to the Earth

system that threaten the future of humankind. Therefore the new global social contract requires creating "a culture of attentiveness (born of a sense of ecological responsibility), a culture of participation (as a democratic responsibility), and a culture of obligation towards future generations (future responsibility)" (WBGU 2011, 277). A particular emphasis is given to the role of governments in creating a new society: the "formative" or "proactive" state (in the original German, the "gestaltender Staat") sets priorities and standards for the "Great Transformation," increases the number of ways in which its citizens can participate, and offers sustainable options for the private sector (WBGU 2011, 277–78). Beyond that, the new social contract suggests new global institutions and new forms of global cooperation—for example, the establishment of a "UN Council for Sustainable Development" and the formation of international alliances of climate pioneers between states, international organizations, cities, corporations, and scientific and civic organizations (WBGU 2011, 316).

In the context of the Anthropocene, this contract draft is interesting, because it follows—maybe not explicitly, but certainly implicitly—an all-embracing institutional approach (von Weizsäcker 2011), which is based on three key ideas: firstly, application of the concept of the social contract to global society; secondly, fixation on the principle of sustainability as a normative standard; and thirdly, agreement that implementation should take place by means of active involvement on the part of states and institutions. But all three of these principles raise serious conceptual questions.

Firstly, the application of the concept of the social contract to global society: the German Advisory Council's revision of classical contract theory as a political framework for governance in the Anthropocene (WBGU 2011, 277) is undoubtedly an improvement, as natural environment is given more consideration than in the classical contract concepts of natural law. And self-organized civil society and the community of scientific experts are given a voice in the revised contract terms. At the same time, though, these revisions assume that the social contract is still an appropriate normative framework for conceptualizing global society. This assumption is questionable at best: the concept of the social contract is too monolithic, too undifferentiated, too uniform, and—especially—normatively too strong to reflect the social, political, and economical pluralism of global society. And this is conceptually even more surprising in a time when network theories are at hand to (re)assemble the social cohesion in a fragmented world (Latour 2005).

Secondly, the fixation on the principle of sustainability as a normative standard: Of course, it was and is revolutionary that sustainability has become the central principle of international, European, and national environmental governance (Beyerlin and Marauhn 2011, 14–17, 73–83; Kahl 2008). But sustainability is—at the same time—in itself a very conservative principle, in that it is concerned with preserving what currently exists (Sloterdijk 2012, 490–91). One can almost hear the voice of Edmund Burke when the term "sustainability" is used: the notion of "a partnership in all science; a partnership in all art; a partnership in every virtue; and in all perfection. As the ends of such a partnership cannot be obtained in many generations, it becomes a partnership not only between those who are living, but between those who are living, those who are dead, and those who are born" (Burke [1790] 1986, 194–95; Haverkate 2005). Nothing against Edmund Burke! But the ecological developments characterizing the Anthropocene are already beyond the point where the conservative principle of sustainability could possibly offer any guidance. What does sustainable development mean with regard to the collapse of biodiversity? The losses of biodiversity are irreversible and accelerating. This is not sustainability, and even resilience seems scarcely possibly for such damaged ecosystems (Kersten 2012). What does sustainable development mean when considering the path of nuclear energy: Three Mile Island—Chernobyl—Fukushima? Nuclear pollution has already turned parts of our planet into no-go areas. And the long-term disposal of nuclear waste constitutes one of the most hazardous mortgages on our collective future: "Some nuclear wastes and part of Chernobyl's fallout"—so John McNeill—"will be lethal for 24,000 years—easily the most lasting human insignia of the twentieth century and the longest lien on the future that any generation of humanity has yet imposed" (McNeill 2000, 313). We are far beyond sustainable development here as well: We do not have to assess options for sustainable development, but dangerous situations and futures (Spaemann 2011, 7–11).

Thirdly, the agreement to implement change through comprehensive, proactive measures: When the Advisory Council called for a "gestaltender Staat"—a "proactive state"—it of course had in mind a state with an active political agenda that would set standards decided in part through democratic participation and an extensive dialogue with and within civil society (WBGU 2011, 203–9). But the German term "Gestaltung"—"shaping" or "formation"—develops a quite different significance when we consider that the Anthropocene challenges the traditional distinction between nature and culture. In today's world, ecosystems and landscapes are no longer untouched. They are

influenced, if not designed, by humans. So it cannot be a real surprise that "planet gardening" by "world gardeners" has become a leitmotif in the Anthropocene (Schwägerl 2012, 349; Leinfelder 2013; Lenzen 2013). Reinhold Leinfelder has explained what is meant by this: the Anthropocene concept highlights how we can no longer trust the traditional antagonism of "good" nature that has to be preserved and "bad" technology that has to be contained. Nature and culture are part of a single, unified system that has to be proactively "gestaltet"—arranged, designed, configured, constructed, mapped, and shaped—in a sustainable way in order not to lose its balance (Leinfelder 2013), or rather, its "stable unbalance" (Reichholf 2008, 115–37). In this argument, the culture of the Anthropocene is a *cultura* in the etymological sense of this Latin term and focuses therefore on "handling, care, and cultivation" of nature in the "rambunctious garden" of a "post-wild world" (Marris 2011).

Taken together, then, the key elements of this global social contract call for an all-inclusive Anthropocene *cultura*. From the perspective of law, there are instruments that could be taken up and developed to implement this institutional approach legally. The concepts of the common heritage or the common concern of humanity try to combine legal mechanisms governing cultivation, education, harvest, justice, participation, property, protection, research, solidarity, and the use of global commons or global public goods.

But these legal perspectives do not answer the key legal question: Should we really give up an adversative normative understanding of the relationship of nature and culture in favor of a legal approach that institutionalizes a cultural design of nature and a natural design of culture guided by the overall principle of sustainability? There is no definitive answer to this question. It depends very much on what model of human nature we base our political anthropology on: If, following Hobbes, we believe that the "life of man" is "solitary, poore, nasty, brutish, and short," human selfishness will lead us to value our own social and economic welfare over ecological values in an institutionalized sustainability model of the Anthropocene. Our political experience of the last two hundred years since the beginning of industrialization, which are the last two hundred years of the Anthropocene, tells us: When EGO-systems meet ECO-systems, the ECO-systems usually lose.

With the loss of the normative distinction between culture and nature, nature is at risk of losing the normative resistance, reluctance, and resilience that it has won in the

legal developments of the last 30 years. And even worse: Because the institutionalized concept is legally all-inclusive, there can be no legal criticism or even legal opposition from "outside" when nature is culturally consumed. All decisions concerning nature and sustainable development are made within a comprehensive institutional framework. If you want to take part in the decision-making, your voice has to be legally comparable to and legally recognized by the framework's institutions. If you do not share principles of the institutional design, you are legally precluded from the decision-making. These exclusions will especially affect the political activism that has given nature a sensible and radical voice in the social and economic welfare discourses of *Homo sapiens pauper* in their (post)industrial societies, which will dominate an all-embracing institutional design of the world contract for sustainability. Therefore, the comprehensive institutionalism of the Anthropocene *cultura* will not offer the necessary legal dam against the selfish and destructive forces of the *Homo sapiens pauper.*

A Conflict Model of the Anthropocene

The Anthropocene was in the past, is at present, and will be in the future a period not of harmony created by institutions, but of severe global conflicts of national and economic interests for resources, driven by social welfare, market competition, and—of course—by political sovereignty (Welzer 2010). These social, political, and economic interests threaten individual ecosystems as well as the ecological balance of the whole globe. I therefore favor a conflict model of the Anthropocene that is still based on the *normative* distinction between culture and nature, and in these conflicts nature needs—at least in my view—a strong legal voice.

As I have shown, an institutionalized legal approach guided merely by sustainability does not ensure that nature is given this strong legal voice. If, however, our approach to governing the Anthropocene is based on an understanding of society, economy, and ecology as a series of conflicts between different interests, then the role of law is to protect nature in this conflict and give it a voice that it otherwise would not have. In this model, the basic rule for the solution of ecological conflicts reads: Every intervention into the natural world—air, climate, fauna, flora, soil, water—has to be justified by socially and economically *reasonable reasons*. So in this concept of "ecological liberalism," the burden of proof to legitimize interventions into ecological systems is shifted:

Society and economy have to justify every single use of nature and every single design of eco-structures. Nature is legally not free of charge anymore.

The most important point in this balancing of interests is that sustainability is no longer the primary criterion for making decisions; the principle of ecological resilience must also be considered. In this context, resilience—related to the concepts of vulnerability, adaptation, and coping strategies—describes the capability of (eco)systems to tolerate disturbance (Allenby and Fink 2005; Ehlers 2008, 16–17; Gusy 2013, 995–97): Criteria determining ecological resilience are an ecosystem's power to preserve its self-organization and basic functions, and its capacity of adaption to and neutralization of interventions from outside. These criteria make it possible to evaluate social or economic interventions into ecosystems in a "de-escalation model," which turns around the escalating deformation and destruction of the Earth's ecosystems by focusing on the three legal categories of danger, risk, and balance. In the case of danger for an ecosystem, no social or economic interventions are allowed at all. In the case of risk for an ecosystem, social or economic interventions are allowed only if an adaption of the ecosystem is probable or if the ecological consequences of the intervention are easily reversible. Finally, in the case of a stable ecosystem, social or economic interventions are allowed if they live up to classical sustainable standards.

Of course, this conflict model has its problems as well. Let me address two of them. The first problem is concerned with the key question of the Anthropocene: What is meant by "nature" in that legal discourse, if nature in the Anthropocenic *cultura* is and will be in most cases socially and economically "designed nature"? The answer to this question is quite easy from a legal perspective: law can treat even designed nature as "nature." This legal gift of fictitious normative thinking with (contra-)factual consequences in the real world enables us to value the "designed nature" of the Anthropocene as and like "natural nature" in the sense of law and to apply the basic rule and the "de-escalation model" developed above. To illustrate that with an example: a tree in the "rambunctious garden" that represents the post-wild Anthropocenic *cultura* might be "gestaltet" ("designed"), but can be protected by law like any "natural tree." This approach has the advantage that we reflect on social, economic, and ecological co-evolution in the long run by deciding on any social and economic driven intervention into ecosystems in every single case.

The second problem of this approach is the understanding of *Homo sapiens pauper:* Will nature not end up as the loser in this conflict model, just as, I have argued, it does in the institutional approach, if *Homo sapiens pauper* is still *Homo sapiens pauper*? Again, there is no straightforward answer to this question: My argument for the conflict model is that it reflects the legal problems of the Anthropocene with more transparency, that it can give nature—hopefully—a stronger legal and political weight in every single conflict, and that it allows legal criticism and political opposition against the social and economic decomposition of nature "from outside the system." So the conflict model is a theoretical and legal reaction to the anthropological assumption of the *Homo sapiens pauper.* However, this model is not the only possible approach. If we were to base our political anthropology on a different model of human nature—not Hobbes' *Homo sapiens pauper*, but something else—the balance between social and economic interests and values of nature will also change.

From *Homo sapiens pauper* to *Homo sapiens luxus*

After this assessment of the Anthropocene, the central question is: What therapy would the *Homo sapiens pauper* accept? What changes in political anthropology are reasonable and realistic? And the answers to these questions are important, regardless of whether you prefer a comprehensive institutional approach or the fragmented conflict model to understand the Anthropocene.

In our answer we can follow and criticize a conservative line of anthropological thinking in Germany that developed between 1930 and 1990 as an "anthropology of the technological age" (Sloterdijk 2001; 2004, 699–711; Leggewie and Welzer 2011, 100–102). It was Arnold Gehlen who came up with the idea of humans as "Mängelwesen"—humans as "deficient creatures" (Gehlen [1940] 1988). Gehlen took up Friedrich Nietzsche's description of humans as the "nicht festgestellte Tier"—humans as the "animal whose nature has not yet been fixed" (Nietzsche [1886] 1990, 88). On this basis, Gehlen developed his anthropological theory that humans, as unadjusted and unspecified creatures, will do everything to compensate for their sensual "openness" by creating social, political, religious, and technical institutions that promise cognitive relief and allow action in a complex world. The crucial point of this approach is not the more-or-less plausible explanation of the development of culture, but the normative turn of this anthropology:

Humans as "deficient creatures" do not simply develop technical and cultural institutions to compensate for their own deficiencies. They think that they have the right to do so. So we see here not a mere descriptive but a highly normative theory, in which humans try to gain a normative title for an "Inkompetenzkompensationskompetenz"—for a "competence in compensating for incompetence" (Marquard [1973] 1989)—with disastrous consequences for the exploitation and pollution of nature.

But this normative turn was not enough for the self-immunization of humans against the consequences of their self-imagined deficiencies. Niklas Luhmann offers another explanation, referring this time not to humans' physical deficiencies but to their intellectual limits (Luhmann [1984] 1995, [2002] 2013): The world according to Luhmann is far too complex for humans. Humans cannot understand the complex world and therefore create systems based on binary distinctions that represent simplified pictures of the world. They communicate in terms of the code of each system: economics, education, law, politics, religion, science, and so on. But in this epistemological tradition of the "deficient creature" no one can be baffled by the fact that systems theory does not know the "ecology of society" (Luhmann [1986] 1989): the environment is not a social subsystem. Furthermore nature has no counterpart in society, because "society" as a whole has no representation (anymore). And it is even difficult to speak of "ecological communication," because the subsystems of society only understand their specific code. When they consider ecological questions at all, it is within their particular framework; outside of this framework, "ecological communication" is for them just a disturbance.

If we follow the logical consequences of this "modern" picture of *Homo sapiens pauper,* one thing is quite clear: If we are indeed naturally poor beings with a right to compensation for our deficiencies, and if our mental capacities are limited to an "ecology of ignorance" (Luhmann [1992] 1998, 75), then humans do not have a long future in the Anthropocene. But what are the limits and potentials of humans in the Anthropocene?

The limit is—in my opinion—the Hobbesian assumption of individual selfishness. We will not change that, and that is why I would prefer the conflict model to solve the clashes of social, economic, and ecological interests in the Anthropocene. On the other hand, with a purely egoistic habitus humanity will not be able to establish the barriers necessary to prevent self-destruction. Of course, in the Hobbesian model death

and destruction are the only motivation for humans to enter into the social and political contract in order to survive. But this motivation for humans to "behave" is not sufficient in the Anthropocene. The reason for that is not the overall apparent reluctance to accept the apocalypse as an argument in our ecological discourses: Predictions of impending doom are not regarded as "helpful." The Anthropocenic bourgeoisie do not fear anything but an "ecological Puritanism" that calls for a change in their habits or even in their lives (Sloterdijk 2011, 105; 2009, 709–14; Reichholf 2008, 133–34). They regard all notions in this direction as the road to "ecological dictatorship"—a very ambivalent argument, because the Anthropocenic bourgeoisie promotes the "dictatorship" of economic reason in their everyday lives.

Nevertheless, apocalyptic worst-case scenarios are problematic when they lead to reactions that only exacerbate the situation (Sunstein 2007, 6–7; Schwägerl 2012, 356–57). One of these overreactions has already been described as the "Green Paradox" by Hans-Werner Sinn (2012): The fear of having their activities restricted as a result of green politics might encourage the proprietors of natural resources to exploit them even faster and to cash them as soon as possible on the world markets, with dramatic consequences for the environment. On the other end of the spectrum, neglect could prevail in the Anthropocene as well, especially with respect to its long-running developments of climate change and biodiversity losses. The Anthropocenic bourgeoisie could react with a devil-may-care-attitude, which would make the bad ecological developments even worse (Sloterdijk 2011, 105; Schwägerl 2012, 356–57; Giddens 2009, 2). So the Anthropocene might result in defeatist Anthropocynicism.

How, then, should the probability of apocalypse be handled in the Anthropocene? In this context, Peter Sloterdijk has encouraged us to develop a "Critique of Prophetic Reason" (Sloterdijk 2011, 96). We should not assume that something is inevitable just because it is predicted; nor should we fall into the trap of believing that a prophecy was a panic-making overreaction simply because we were warned in time to prevent disaster. Worst-case scenarios are political arguments that always visualize their catastrophic projections within the context of the social concept of time. Thomas Hobbes has shown what that means in the *Homo sapiens pauper's* worst-case scenario of civil war: war consists not just of the period of active fighting, but in the disposition towards war (Hobbes [1651] 1985, 185–86). Because times of war are in part socially conceived, citizens should not be discouraged from trying to prevent war, but rather motivated to

behave peacefully. Those who still have time also still have political options and may act to prevent worst-case scenarios.

This basic idea of a "Critique of Prophetic Reason" could motivate humanity in the Anthropocene as well. There are political options in the timeline of present and anticipated ecological developments. But in order to realize and to implement these political options in the Anthropocene, humans have to change their habitus. Hobbes could stick to the picture of *Homo sapiens pauper* in his description of the problem (war) and his presentation of the solution (state), because both—war and state—focus on the security of humans as possessive individualists (Macpherson 1962). In the Anthropocene, the character of *Homo sapiens pauper* is—again—part of the problem: They use natural resources in an egoistic way that threatens the balance of individual ecosystems and the ecological balance of the whole globe. But exactly for this reason—the egoistic consumption of nature—*Homo sapiens pauper*, who does not know anything but self-interest, cannot be the answer to the ecological challenge of the Anthropocene. For that reason, "nature" emerges in the Anthropocene as the non-human third party that has been neglected in the classical contract theories of natural law.

Therefore, the Anthropocenic self-understanding of humans has to reflect "nature" not only as a value in itself, but in its inseparable connections with all social and economic dimensions of human life. This requires a paradigm shift in the political anthropology of the Anthropocene. Peter Sloterdijk (2004, 699–711) has shown us how we can move from *Homo sapiens pauper* to the *Homo sapiens luxus*: Humans are not just poor animals, they are also rich ones. They have emotional and intellectual capacities to reflect their embeddedness in various social, economic, and—especially—ecological contexts that are inseparably connected in the Anthropocene (Leggewie and Welzer 2011, 106–10). This has consequences for our understanding of our place in the world.

In accordance with the rights of humans on this planet, we must move beyond our understanding of ourselves as self-victimizing creatures, a victimization for which we seek compensation, especially compensation from global nature. If we change our self-understanding and see ourselves not as a poor but as a rich species, we will more easily follow the paradigm shift of the conflict model and at least accept its basic rule, together with the "de-escalation approach." This would allow us to change our active lives of individual freedom and our passive lives in our collective infrastructures to be more

respectful of nature and the resilience of the global ecosystem(s). We must stop hiding behind the strategic concept of defensive ignorance. We can no longer use the argument of complexity reduction as the decisive element in political anthropology. On the contrary, we can and we should establish and develop an Anthropocene culture that enjoys complexity—and again: enjoys complexity in our active lives of individual freedom as well as in our passive lives in collective infrastructures.

With this enjoyment of complexity, *Homo sapiens* has the chance to develop a more modest self-understanding and might even overcome the diagnosis of an "Unbehagen in der Natur" (Žižek 2008, 420)—a "discontent in nature"—as the new psychological status of humanity in the Anthropocene. Humans will be citizens of the Anthropocene when they begin to enjoy the complexity of their age.

References

Allenby, Brad, and Jonathan Fink. 2005. "Toward Inherently Secure and Resilient Societies" *Science* 309 (5737): 1034–36.

Beyerlin, Ulrich, and Thilo Marauhn. 2011. *International Environmental Law*. Munich: Hart, C. H. Beck, and Nomos.

Burke, Edmund. (1790) 1986. *Reflections on the Revolution in France, and on the Proceedings in Certain Societies in London Relative to that Event*. London: Penguin.

Crutzen, Paul, and Christian Schwägerl. 2011. "Living in the Anthropocene: Toward a New Global Ethos" *Environment 360*, 24 January. http://e360.yale.edu/feature/living_in_the_anthropocene_toward_a_new_global_ethos/2363. Accessed 19 February 2013.

Crutzen, Paul, Mike Davis, Michael D. Mastrandrea, Stephen H. Schneider, and Peter Sloterdijk. 2011. *Das Raumschiff Erde hat keinen Notausgang: Energie und Politik im Anthropozän*. Berlin: Suhrkamp.

Ehlers, Eckart. 2008. *Das Anthropozän: Die Erde im Zeitalter des Menschen*. Darmstadt: Wissenschaftliche Buchgesellschaft.

Gehlen, Arnold. (1940) 1988. *Man: His Nature and Place in the World*. Translated by Clare MacMillan and Karl Andrew Pillemer. New York: Columbia University Press.

Giddens, Anthony. 2009. *The Politics of Climate Change*. Cambridge: Polity Press.

Gusy, Christoph. 2013. "Resilient Societies: Staatliche Katastrophenschutzverantwortung und Selbsthilfetätigkeit der Gesellschaft." In *Verfassungsstaatlichkeit im Wandel: Festschrift für Thomas Würtenberger zum 70. Geburtstag*, edited by Dirk Heckmann, Ralf P. Schenke, and Gernot Sydow, 995-1010. Berlin: Duncker & Humblot.

Haverkate, Görg. 2005. "Langzeitperspektiven im Recht: Edmund Burkes Gesellschaftsvertrag." In *Recht-Kultur-Finanzen: Festschrift für Reinhard Mußgnug zum 70. Geburtstag am 26. Oktober 2005*, edited by Klaus Grupp and Ulrich Hufeld, 555–63. Heidelberg: Müller.

Hobbes, Thomas. (1651) 1985. *Leviathan, or The Matter, Forme, & Power of a Commonwealth Ecclesiasticall and Civill*. London: Penguin.

Kahl, Wolfgang, ed. 2008. *Nachhaltigkeit als Verbundbegriff*. Tübingen: Mohr Siebeck.

Kersten, Jens. 2012. "'Im Dickicht der Städte'—Biodiversität und Stadtentwicklung." *Umwelt- und Planungsrecht* 32 (1): 15–22.

Latour, Bruno. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

Leggewie, Claus, and Harald Welzer. 2009. *Das Ende der Welt, wie wir sie kannten: Klima, Zukunft und die Chance der Demokratie*. Frankfurt am Main: Fischer.

Leinfelder, Reinhold. 2013. "Wir Weltgärtner." *Die Zeit,* 10 January. http://www.zeit.de/2013/03/Anthropozaen-Projekt-Berlin-HKW-Leinfelder. Accessed 19 February 2013.

Lenzen, Manuela. 2013. "Die Vorzüge künstlicher Feuchtgebiete." *Frankfurter Allgemeine Zeitung*. 1 February: 34.

Luhmann, Niklas. (1984) 1995. *Social Systems*. Translated by John Bednarz, Jr., with Dirk Becker. Stanford: Stanford University Press.

———. (1986) 1989. *Ecological Communication*. Translated by John Bednarz, Jr. Cambridge: Polity Press.

———. (1992) 1998. *Observations on Modernity*. Translated by William Whobrey. Stanford: Stanford University Press.

———. (2002) 2013. *Introduction to Systems Theory*. Translated by Peter Gilgen. Cambridge: Polity Press.

Macpherson, Crawford Brough. 1962. *The Political Theory of Possessive Individualism: Hobbes to Locke*. Oxford: Clarendon.

Marquard, Odo. (1973) 1989. "Competence in Compensating for Incompetence? (On the Competence and Incompetence of Philosophy)." In *Farewell to Matters of Principle. Philosophical Studies*. Translated by Robert M. Wallace with the assistance of Susan Bernstein and James I. Potter, 22–37. New York and Oxford: Oxford University Press.

Marris, Emma. 2011. *Rambunctious Garden: Saving Nature in a Post-Wild World*. New York: Bloomsbury.

McNeill, John R. 2000. *Something New under the Sun: An Environmental History of the Twentieth-Century World*. New York: Norton.

Nietzsche, Friedrich. (1886) 1990. *Beyond Good and Evil: Prelude to a Philosophy of the Future*. Translated by R. J. Hollingdale. London: Penguin.

Radkau, Joachim. 2011. *Die Ära der Ökologie: Eine Weltgeschichte*. Munich: C. H. Beck.

Reichholf, Josef H. 2008. *Stabile Ungleichgewichte: Die Ökologie der Zukunft*. Frankfurt am Main: Suhrkamp.

Schwägerl, Christian. 2012. *Menschenzeit. Zerstören oder gestalten? Wie wir heute die Welt von morgen schaffen*. Munich: Goldmann.

Sinn, Hans-Werner. 2012. *The Green Paradox: A Supply-Side Approach to Global Warming*. Cambridge, MA: MIT Press

Sloterdijk, Peter. 2001. "Luhmann, Anwalt des Teufels: Von der Erbsünde, dem Egoismus der Systeme und den neuen Ironien." In *Nicht gerettet: Versuche nach Heidegger,* 82–141. Frankfurt am Main: Suhrkamp.

———. 2004. *Schäume: Sphären III*. Frankfurt am Main: Suhrkamp.

———. (2009) 2013. *You Must Change Your Life*. Translated by Wieland Hoban. Cambridge: Polity Press.

———. 2011. "Wie groß ist 'groß'?" In Paul Crutzen, Mike Davis, Michael D. Mastrandrea, Stephen H. Schneider, and Peter Sloterdijk, *Das Raumschiff Erde hat keinen Notausgang: Energie und Politik im Anthropozän*, 93–110. Berlin: Suhrkamp.

———. 2012. *Zeilen und Tage: Notizen 2008–2011.* Berlin: Suhrkamp.

Sombart, Werner. 1928. *Der moderne Kapitalismus: Das Wirtschaftsleben im Zeitalter des Hochkapitalismus*. Volume 3. Berlin: Duncker & Humblot.

Spaemann, Robert. 2011. *Nach uns die Kernschmelze: Hybris im atomaren Zeitalter.* Stuttgart: Klett-Cotta.

Steffen, Will, Jacques Grinevald, Paul Crutzen, and John McNeill. 2011. "The Anthropocene: Conceptual and Historical Perspectives." *Philosophical Transactions of the Royal Society A* 369: 842–67.

Sunstein, Cass R. 2007. *Worst-Case Scenarios*. Cambridge, MA, and London: Harvard University Press.

WBGU [German Advisory Council on Global Change]. 2011. *World in Transition: A Social Contract for Sustainability.* Translation of *Welt in Wandel: Gesellschaftsvertrag für eine große Transformation.* Berlin. http://www.wbgu.de/fileadmin/templates/dateien/veroeffentlichungen/hauptgutachten/jg2011/wbgu_jg2011_en.pdf. Accessed 19 February 2013.

Weizsäcker, Carl Christian von. 2011. "Die große Transformation: Ein Luftballon." *Frankfurter Allgemeine Zeitung*, 30 September: 12.

Welzer, Harald. 2010. *Klimakriege: Wofür im 21. Jahrhundert getötet wird*. Frankfurt am Main: Fischer.

Žižek, Slavoj. 2008: *In Defense of Lost Causes*. London and New York: Verso Books.

Nina Möllers

Cur(at)ing the Planet—How to Exhibit the Anthropocene and Why

The Anthropocene is a geological hypothesis and a conceptual framework that is currently being probed for its phenomenological and epistemic relevance in a wide array of scientific disciplines. As a unifying concept giving a name to manifold problems and environmental challenges, it has both proponents and opponents. Still open for discussion and interpretation, the Anthropocene requires us to think hard, reflect, and debate in order to develop mechanisms, structures, and values for shaping and living in this "epoch of humans." Its undeterminedness makes the Anthropocene an unfamiliar and challenging topic for several reasons. Because the Anthropocene's temporal boundaries are still unclear, it contests the somewhat comforting periodization of history, depriving us of anchors for interpreting our past and asking us to look anew at the relation between human and Earth history. It focuses on human beings as *dramatis personae*, but situates them firmly in and of the natural world, bringing up not just scientific, social, and cultural, but also fundamental philosophical and ethical questions.

Regardless of whether the Anthropocene is formalized at some point by international scientific bodies as a new current geological epoch, there is already a large amount of agreement in academic communities as well as in politics and the media that humans have substantially altered planet Earth in the last two centuries on a hitherto unknown scale. Yet, while the natural sciences, humanities, and social sciences give us a reasonably good picture of how this came about, we are as of now not yet sure how to understand the implications of the Anthropocene. We may argue that the Anthropocene clearly manifests itself in the nature that has been changed by human intervention, in our cities, in the communication worlds that we have created, and in our consumptive lifestyles, but it is only now beginning to find its aesthetic, artistic, and literary voice. Because the Anthropocene fundamentally tests so many assumptions, interpretations, and historically sedimented concepts, among them linear interpretations of history and progress and the promise of control that we have found in science and technology, we find its indeterminacy troubling. However, it is exactly this fuzziness that makes the Anthropocene concept so intriguing and highly promising for creative renderings and negotiations, particularly in the realm of exhibitions.

The concept of the Anthropocene does not automatically provide answers. In fact, its main merit may be that it forces us to ask new questions. On the surface, these may seem familiar: What do we eat? How do we get from place to place? What will our cities look like? Are machines slowly taking over control in our highly automated world run by invisible algorithms? From the Anthropocene perspective, these seemingly typical questions of modernity gain new relevance in view of the growing importance of systemic relationships between natural and social spheres, of interactions between global and local phenomena and actions, and of the relatedness of our present to the deep past and future. This new understanding of the *longue durée* challenges not only many academic disciplines, particularly the humanities, but also (historical) museums with their traditionally retrospective perspective. Aside from the temporal aspect, the Anthropocene forces us to leave our comfort zone in many respects, asking us to think in unfamiliar connections and to cross traditional disciplinary boundaries. To be able to do so, we need to develop a common language across disciplines and cultures—a challenge on its own—and to open our ears and eyes for new verbalizations and views. Museum exhibitions can help us to develop the necessary skills, as they allow for thinking in three-dimensional space, circumventing mental barriers, and offering opportunities for shortcuts and detours without ending up in dead-ends.

These great opportunities are of course coupled with similarly great challenges. The Deutsches Museum has decided to tackle these head-on and become the first museum to create a major exhibition on the Anthropocene. The exhibition is a joint venture of the Deutsches Museum and the Rachel Carson Center for Environment and Society, covering 1,400 square meters and opening in the fall of 2014. The Anthropocene fits squarely into the museum's tradition and unique founding philosophy while carrying it into the twenty-first century. The choice of the Anthropocene as the subject of an exhibition not only reflects the museum's established interest in the interfaces and feedback between the natural sciences, technology, and social and cultural contexts, but also its strong concern for timescales spanning the past and present and reaching into the future. Furthermore, the museum has always been built on the strong belief that its galleries serve as spaces for reflective, interactive, and participatory involvement with current and controversial issues, providing visitors with the knowledge needed to form their own opinions.

Translating a theoretical concept and its underlying arguments into an exhibition space is always ambitious. Exhibitions construct their arguments in space, using a multitude

of communication tools ranging from original (historical) collection objects to images, films, graphics, texts, installations, lighting, and scenic spatial arrangements. The Anthropocene as a geological hypothesis and new framework of thinking lifts these curatorial demands of translation onto yet another level. At the same time, however, the Anthropocene's main challenges—its doubleness as both a geological theory and a philosophical concept, its openness and reflexiveness, its spatial and temporal totality—make the exhibition a very suitable medium for negotiating its content and meaning.

Despite this duality, which complicates a clear conceptualization and concrete operationalization of the Anthropocene as a research tool, the geological basis of the Anthropocene concept is of importance. It frames and feeds our current discussions about human interventions into nature, starting with industrialization and leading to globalized and globalizing cause-and-effect relationships connecting producers and consumers, profiteers and needy, perpetrators and victims, and a growing blurring of these categories. Because of their use of space, exhibitions provide an excellent way of creating "contact zones" where the two aspects of the Anthropocene concept—geological and philosophical—and categories usually constructed in binary opposition, like nature and culture, can meet and mix. Instead of following a linear narrative structure, an exhibition allows for spatial juxtapositions, creating surprising connections and tensions that enable us to see current phenomena in the context of geological development. Throughout the exhibition at the Deutsches Museum, the geological stratigraphic element will highlight the geological aspect of the Anthropocene concept while also reconnecting topics such as nutrition, urbanization, and mobility to the question of what the Anthropocene will leave in the geological record for coming generations of humans and other species.

A very clear connection between the geological aspect of the Anthropocene and its relevance as a new framework for conceptualizing human influence on the surrounding bio-, geo- and sociospheres are the material objects that we produce, consume, and collect. Museum objects represent in and of themselves specific points in time and their particular social, political, economic, cultural, and environmental contexts. In their materiality, they conserve history, traditions, knowledge, and usage while simultaneously being wrested from their original contexts. In museological terms, objects in exhibitions constantly oscillate between actualization and latency, speaking to a temporal differentiation between the present time of the here and now and other time(s) embedded in the object (Vedder 2005, 183). In the exhibition, this inherent characteristic of museum

objects may actually help us in imagining and understanding the great and manifold, often overlapping temporal dimensions of the Anthropocene.

As material manifestations of our human actions, objects also provide us with the necessary spatial presence and anchor points from which to explore the promising, but at times frightening openness of the Anthropocene as both a physical phenomenon and a philosophical framework. One of its most unique traits is the fact that we are discussing, researching, and shaping it as it happens. Not only for geologists, but also historians and other scholars as well as the general public, this is new, intimidating, and to the minds of some, even dangerous. The openness of the Anthropocene confronts the museum, the curators, and exhibition-makers, as well as the visitors with new challenges. While exhibitions are always selective representations of specific interpretations of our world, the quality of uncertainty that surrounds the Anthropocene particularly challenges the traditional perception of museums as agencies and meditators of knowledge where people can learn how things "really are" and "how they work." In the Anthropocene, the museum cannot (and maybe no longer should) offer this assurance of certainty. Instead, the museum should become what has often been demanded of it but rarely realized: a forum for reflection, discussion, negotiation, and even controversy. Museums of science and technology in particular can no longer pretend to authenticate knowledge, nor can the public continue to expect this. What museums and exhibitions can accomplish and should be called upon by the public to do is to create space—literally and figuratively—for free thinking, discussion, and visualization of the Anthropocene.

This does not mean that the museum loses its credibility, its scientific methodology, or its function as a space for lifelong learning and entertainment. On the contrary, it means that museums and exhibitions become more self-reflective, acknowledging what has been the case all along, namely that the sciences, and with them the spaces where they are represented, discussed, and translated for the wider general public, are also spaces of uncertainty, fragile knowledge, ambivalence, and controversy. What may at first seem like a complication, maybe even a loss, turns out to be a necessity, even an asset in the Anthropocene, as it supports and aims to produce the informed and critical, yet enthusiastic citizenry that is needed if the transformations called for in the Anthropocene are going to take place. Along the lines conceived by Sigfried Giedion, who demanded as early as 1929 that museums should become a "lively chronicle of time showing the things while they are in flow and not when they start to lie in their historical

coffins" (Giedion 1929, 103–4), museums and exhibitions need to present topics, issues, and controversies while they happen. Especially in terms of technological solutions to environmental problems, museums of (historical) technology are in a superb situation to contextualize technology both historically and systematically in a way that individual research institutions, political and economic agents, and even the media cannot. For this reason, the ambivalence of technology both as part of the problem and part of possible solutions will play a major role in the Anthropocene exhibit, because a democratically participatory assessment of technologies and their potentials, risks, and usefulness is needed for the shaping of the Anthropocene.

In addition to the doubleness and indeterminacy of the Anthropocene concept, it confronts the exhibition curators with a complexity on all levels. The Anthropocene basically comprises thousands of years, the entire globe, and a multitude of phenomena, topics, and issues that are systematically and spatially interwoven. Again, material objects intentionally or inadvertently created by human action serve as superb crystallization and junction points where relations, applications, experiences, and opinions towards certain issues meet and have become material, waiting to be decoded. Although objects in museums are taken out of their original contexts of production, usage, consumption, or adaption, they still bear traces of their origins that tell us, according to Anke te Heesen, a lot about ourselves, our rationalities and emotions, our expectations, and our fears (te Heesen 2012, 176). Because museum objects are simultaneously close and remote, present in the here and now while also anchored in the past, and embedded in a global network of things while being charged with personal and local meaning, they are particularly well suited to concretize the Anthropocene, make it imaginable and even tangible, and thus provide a focal point and base for reflection and discussion of Anthropocene phenomena and effects.

A final challenge for an exhibition on the Anthropocene is the criticism that, beyond the strict geological discussion, the concept offers little concrete guidance about how to turn discourse into transformative action. Here again, museums and exhibitions may rediscover old strengths by focusing on yet another unique characteristic that they have: spatiality and the opportunities it offers for new and unexpected perceptions and movement and participation. Only exhibitions can build their arguments in space, visualize them, and offer them for the public to engage with, reflect upon, and debate. In the multi-perspective and nonlinear exhibition space, visitors get the opportunity to make

their own decisions, form their own experiences, and thus come up with different interpretations. The Anthropocene exhibition at the Deutsches Museum will reflect this participatory element not only by including interactive elements throughout the gallery, but particularly by integrating visitors' reactions into the design of the exhibition. In the last section, which is concerned with scenarios of the future, the visitors themselves will decide which scenario they find most probable and/or most desirable, thereby directly speaking to the visitors as agents in the shaping of the Anthropocene.

In museum studies, the Enlightenment has often been emphasized as a formative period for the history and development of museums. It was in these confusing times of awakening, change, and social transformation, so the story goes, that museums developing out of aristocratic collections and cabinets of wonder served as agents of validation for social orders and worldviews. Along similar lines, museums have been interpreted as spaces of compensation where the loss of traditions and resulting disorientation caused by a developing bourgeois society and the modern industrial nation-station could be balanced (Ritter [1963] 1974). The times that we live in and the future ahead of us, whether we call it Anthropocene or something else, share important elements with past periods of transition and transformation. Today's globalized world, increasingly marked with the traces of humans and their technological power, calls for a transformation on an unprecedented scale. In this process, museums and exhibitions are no longer mere agencies of remembrance and musealization, working against oblivion. Rather, they have become active scientific, social, and public spaces, offering a unique approach to the Anthropocene. With their ever-growing collections of objects that have produced the Anthropocene and are being produced by it and their representation in spatial arrangements, the exhibition floor offers a unique space for creating a three-dimensional experience of the systemic interconnectedness that characterizes the Anthropocene. Allowing for visualized connection, juxtaposition, and opposition, the spatiality of exhibitions provides for multi-perspective approaches to Anthropocene phenomena, encouraging interaction, participation and discussion in a multimedia and multidirectional way. While curating an exhibition, we also tackle the question of how to "curate" the planet in its literal sense of taking care of it and curing it. The exhibition at the Deutsches Museum will offer a first step in this endeavor by creating an open, informative, and inspiring space for reflection and participatory discussion about the Anthropocene and how to live in it.

Outline of the Exhibition

The exhibition's main goal is to inform visitors about the Anthropocene as a scientific hypothesis and a currently debated global vision of the role of humans on Earth. It shows the effects of humans intervening as a biological and geological actor, increasing awareness for both the temporal and spatial extent of human-invoked environmental changes. By translating the multifarious topics and approaches to the Anthropocene into a three-dimensional space, the exhibition offers to a wider audience the unique opportunity to experience the Anthropocene and to learn about the state of current knowledge (as well as knowledge gaps) and ongoing discussions. The exhibition stands at the beginning of a global, democratic, and participatory debate about the Anthropocene. It therefore will not provide final answers to all questions, but rather encourage reflection and discussion, helping to turn insights into action.

The exhibition aims to:

- raise visitors' awareness about the interconnected phenomena of the Anthropocene and illustrate the magnitude of the geological, chemical, and biological effects—both spatial and temporal—of human actions through selected examples.
- examine the ambivalent role of technology, which contributes to many problems but also offers possible solutions, as well as humans' relationship to nature as mediated through technology.
- emphasize the openness and malleability of the Anthropocene.
- make visitors excited about the manifold opportunities for shaping the Anthropocene while simultaneously highlighting and debating the challenges and risks connected with it.
- raise awareness for the responsibility of the individual and the implications of this, especially the interconnectedness of individual actions and global consequences.

The exhibition is structured into three parts, roughly following a chronological focus. The first section provides a comprehensive introduction into the Anthropocene both as geological hypothesis and new conceptual framework. Its central questions are "What is the Anthropocene?" and "Which questions and new thinking result from it?" They are discussed in relation to historically and culturally different definitions of nature, focusing also on the history of humans' desire and methods to measure, understand, and alter their environment. The introduction visualizes the importance of industrialization and the "Great Acceleration" since the 1950s that created and sped up many phenomena of the Anthropocene that are now found around the globe and challenge our planet's ecosystemic balance.

The second part of the exhibition consists of seven thematic areas that present selected phenomena of the Anthropocene, looking particularly at systemic connections, global and local interdependencies, and temporal dimensions. The themes covered are urbanization, mobility, nutrition, evolution, human-machine interaction, nature, and communication/awareness. The urbanization topic plays with how cities function as an organizational principle of the Anthropocene world, serving as nodes in the global networks of goods, raw materials, and waste. The Anthropocene also changes patterns of mobility, as humans move around the world in increasing numbers and with increasing speed as travelers, transporters, and refugees. As both carriers and barriers, humans (im)mobilize other organisms and travel companions such as germs and invasive species. Global interactions also play an immense part in today's nutrition. The eating habits of industrialized societies are expanding worldwide, creating a mammalian super-organism (Flannery 2010). The topics of evolution and human-machine interaction revolve around the human ability to alter life forms—first through domestication and selective breeding, then through genetic manipulation, and nowadays through synthetic biology—and the interface between human beings and their growing population of machines, which they are equipping with ever increasing autonomy and power. The second-to-last topic asks whether there is any nature left unaffected by human activity and

how we might envision nature in the Anthropocenic future. Finally, the last theme explores the question whether the Anthropocene brings about a global consciousness based on fast-developing communication technologies, possibly creating an open "sphere of human thought"—or "knowosphere," as Andrew Revkin (2012) has called it—that facilitates the transformation processes necessary for creating a sustainable future for the planet.

The final section of the exhibition turns towards the future. The initial display looks at past visions of the future, emphasizing their transformative potential while simultaneously highlighting their fragility and ambivalence. The final installation will evoke several scenarios of the future in the Anthropocene, inviting the visitors not only to direct the future through a participatory steering tool, but also to consider the likelihood and desirability of the different scenarios, calling upon each individual to reflect upon their role and wishes in the Anthropocene.

The exhibition will be supplemented by a wide variety of activities ranging from classical formats such as lecture and film series to artistic forums related to the Anthropocene, children's events, and writing, film, and photo workshops. In addition to teaching materials and worksheets for children of various ages, the exhibition will be accompanied by an illustrated catalog in German and English, including a comprehensive essay unit and a section presenting the conceptual and creative background of the exhibition.

References

Flannery, Tim F. 2010. *Here on Earth: A Natural History of the Planet*. New York: Atlantic Monthly Press.

Giedion, Sigfried. 1929. "Lebendiges Museum." *Der Cicerone: Halbmonatsschrift für die Interessen des Kunstforschers & Sammlers* 21: 103–6.

Revkin, Andrew. 2012. "Building a 'Knowosphere,' One Cable and Campus at a Time." *Dot Earth Blog*, 4 January. http://dotearth.blogs.nytimes.com/2012/01/04/welcome-to-the-knowosphere. Accessed 10 June 2013.

Ritter, Joachim. (1963) 1974. "Die Aufgaben der Geisteswissenschaften in der modernen Gesellschaft." In *Subjektivität: Sechs Aufsätze*. Frankfurt am Main: Suhrkamp.

te Heesen, Anke. 2012. *Theorien des Museums: Zur Einführung*. Hamburg: Junius.

Vedder, Ulrike. 2005. "Museum/Ausstellung." In *Ästhetische Grundbegriffe: Historisches Wörterbuch in sieben Bänden*, 148–90. Stuttgart: Metzler.

Sabine Wilke

Anthropocenic Poetics: Ethics and Aesthetics in a New Geological Age

For over a decade now the idea of the Anthropocene, a new epoch of man, has been migrating from its original context in the geological sciences to other academic disciplines, as well as into the popular imagination via magazines and other venues. While the approach developed in these debates is broad and includes perspectives ranging from the sciences to media and the arts, there have been only rudimentary attempts to develop a critique of the underlying assumptions of such a concept. I would like to outline the parameters for such a critique from the perspective of gender and race, postcolonial studies, and the need for a normative framework for global environmental justice. If humanity is indeed the force behind the changes on our planet, then the humanities are called to explore the new directions ahead of us, for they concern themselves with the study of intellectual creation and the critique of dominant narratives, myths, and ideologies, and the critical engagement with fundamental questions of meaning, value, responsibility, and purpose in a period of escalating crisis.

To begin developing such a critical perspective, we need to acknowledge the fact that the concept of the Anthropocene represents nothing less than a serious challenge to the basic axioms of Western metaphysics, specifically Immanuel Kant's transcendental philosophy (Kant [1781] 1855). Kant distinguished between that which we humans can know and what he calls the "thing in itself" (*das Ding an sich*) which cannot really be known by us. The thing in itself lies before and outside of thought and perception. Human perception is limited to phenomena that become the object of our sensory perception. Kant's emphasis on the role of human subjectivity had an enormous influence on how the relation between humans and the non-human world was perceived and consequently constructed in terms of privileging human existence over the existence of non-humans. If no direct connection can be established between pure ideas and objective experiences, we are left with a position that amounts to a transcendental anthropocentrism where objects are said to conform to the mind of the subject and then and only then have the ability to become products of human cognition. Post-Kantian metaphysics rests on this concept of a human-world correlate and it is this presumption that is radically called into question by the idea of the Anthropocene, for in the age of man all relations between humans and non-humans unfold within the realm of interconnectivity.

The concept of the Anthropocene has interesting ramifications if applied to culture and society, since the Kantian position that objects must conform to the human mind in order to become products of human cognition needs to be reconceived in a more phenomenological fashion, recognizing and giving shape to the fact that not only do humans shape the world of the objects, but that all relations between humans and non-humans alter the parties involved. The idea of the Anthropocene hence incites fruitful, revisionist, and critical readings of the canon of Western metaphysics. This is the project of a new philosophical movement called object-oriented ontology. With a philosophical foundation in the writings of Edmund Husserl and Martin Heidegger, object-oriented ontology rejects the Kantian asymmetry that puts human cognition above objective experience and reduces the realm of philosophical investigation to the human-world relation, as though objects were mere props and had nothing to contribute on their own. In the Anthropocene, where the interconnectivity of every part with everything else is an important feature of all world relations and the world of the human and the non-human is profoundly intertwined, a perspective that emphasizes objects, and especially one that foregrounds the idea of an equal footing among object relations, is helpful in order to conceptualize the relationship between humans and their non-human environments.

What does it mean to live in the Anthropocene? To address this question, it is important that we understand the relationship between human beings and place, or embodiment and landscape. Marcel Merleau-Ponty (1964) has explored various ways in which the human body lives in the world in terms of perception and movement. In its pre-reflective state, the perceptual body engages with the world thanks to a certain corporal awareness and through that awareness also transforms this environment. The body as the condition for experience establishes the primacy of perception. If we extend that property to non-human bodies we are able to perceive of worldly engagements in environmental terms as the interconnectivity of humans and non-humans. Such an eco-phenomenological engagement of the human body with the environment is situated in a space that is neither purely objective, because it consists of a multiplicity of lived experiences that motivate the movements of countless organisms, nor purely subjective, because it is nonetheless a field of material relationships between bodies.

One aspect of environmental embodiment in the Anthropocene addresses the fact that we need to engage critically with the predominant mode of relating to nature and the

environment in Western culture, i.e., the culture of looking. Are there alternative ways of embodiment in nature that are not based on the visual gaze that Caspar David Friedrich's canonical figure of the wanderer above the sea of fog enacts so prominently and passionately? Or, phrased differently, can we imagine a multi-sensory dimensional response to landscape that is not automatically enveloped in the paradigm of subjectivity? Such embodied knowledge of landscape has the ability to undercut the visual paradigm. Kant's contemporary, Carl Gustav Carus, may very well have been the first to articulate such a non-visual appropriation of landscape in his concept of "Erdlebenbildkunst" (earth-life painting), a way of painting landscapes in the Romantic tradition influenced by Kant's ideas that not only relies on scientifically accurate observations but also demonstrates knowledge of each object's interrelatedness with its surrounding environment, for example through certain light accents.

More recently, the land art movement, in which artists create art out of the landscape itself, sculpting the soil, rocks, and water into new forms, is an excellent example of a way to explore our embodiment in the environment in the Anthropocene. Such projects combine the dimension of space and environmental location of art with the values of sustainability and an ethics of care and respect toward nature. Land art can draw us toward nature but it can also highlight the artist as shaper of the land, thus emphasizing the geo-engineering qualities of humans in the Anthropocene. It wrestles with a definition of place and it rests on the notion of environmentality of all bodies. The land art movement also reflects a heightened awareness of environmental destruction in the sixties and seventies in line with the publication of Rachel Carson's *Silent Spring* (1962), the proclamation of the first Earth Day in 1970, the first Greenpeace protests against nuclear testing in the early seventies, and early examples of efforts to conserve natural environments. In an age when nature and culture together form the totality of our world, art has the ability to explore the conceptual spaces of the Anthropocene.

In the Anthropocene, we revisit and challenge the limitations of Kantian dualism and reconceive of non-human reality not as something subordinate to human perception, but as related to human reality and interacting with it on equal terms. We also call attention to the historical correlation that can be drawn between the time of the beginning of the Anthropocene, i.e., the age of discovery, and the rise of metaphysics in the Enlightenment. In fact, Chakrabarty (2007) sees a connection between human history and geological data and calls for the opening of historical research to planetary dimensions. But it

was not "humans" in general who engaged in the exploration and resulting colonization of the Americas in the fifteenth and sixteenth centuries, it was European civilization that was driving this process, a process fueled by the need for valued resources. Likewise, it was not "humans" who began depositing carbon into the Earth's crust in the eighteenth and even more in the nineteenth century, but European civilization engaged in the age of discovery and the industrialization and colonization of India, Africa, parts of Asia, and the Pacific. When we remind ourselves of the fact that the actors in this process are all representatives of European cultures, we quickly realize that the term "Anthropocene" actually disguises the fact that a small part of the world's population is single-handedly responsible for depositing that thin carbon layer in the Earth's crust around 1800 and that the values, economic paradigms, and consumption patterns of that one civilization among many now constitute the dominant framework in this new age that we call the Anthropocene.

What is absent from the scientific discourse on the Anthropocene is a postcolonial perspective that points out the fact that we are not talking about generalizable social, economic, and cultural structures and belief systems, but that instead we are describing very specific political, economic, and discursive regimes of power that determined and continue to determine the specific unfolding of world history. The continued existence of these regimes in the Anthropocene necessitates the critique of their basic ideological underpinnings and beliefs. This can be done in a variety of ways, of course, including a critique of the notion of cultural hegemony that is still operative in global culture and institutions today, a critique of state apparatuses, a framework focusing on a discourse analysis of power, a critique of bio-politics, or any other critique following from a critical normative framework. A new critical philosophy in the Anthropocene not only needs to be paired with a postcolonial perspective but also complemented with an environmental justice framework that emphasizes the active role of nature and the environment. In current discussions of the Anthropocene, none of these aspects have been developed in any systematic fashion. A stronger critical framework anchored in a postcolonial and environmental-justice perspective will correct an otherwise rather naïve approach to matters of social and cultural organization in an age where we need to consider networks, global mobility, and the interrelatedness of all objects.

A recent debate published in the newly launched online journal *Environmental Humanities* expressed unease with a conception of the Anthropocene that celebrates the role of technology as part of the solution to creating a sustainable future on Earth in

the age of humans. The discussion participants raised concerns that this could lead to neo-Promethean fantasies that would eclipse disastrous past interventions and establish an ecologically destructive economic system. We should not accept humans as a force of nature uncritically and use science and technology to manage the Earth system as a whole without diligently investigating the discourse of the Anthropocene and uncovering its foundations, implications, worldview, and consequences. These concerns address the need for a critique of the Anthropocene, especially the role of the human as geo-engineer if we choose to uncritically believe in our potential to transform the world with the assistance of technology. In such a vision, nature is no longer thought of as an agency in its own right; instead, it is acted upon by a powerful humankind that is now shaping the Earth and the Earth's future.

An ethics of the Anthropocene must embrace a principle of responsibility as it was developed, for example, by the German philosopher and ethicist Hans Jonas in 1979 in a book in which he reconceived Kant's categorical imperative for an ecological age, proposing an ecological imperative that considers not just the immediate effects of our actions upon other people, but the long-term effects upon the entire living and non-living world. Within such a long-term perspective we are asked to act in such a way that the effects of our actions are sustainable with the idea of the permanence of life on Earth. Jonas's ideas could be the starting point for developing concepts of sustainability for the Anthropocene, especially if we add a postcolonial and more decidedly environmental dimension to this ecological imperative and develop a normative framework for a global environmental justice concept that highlights historical, social, economic, political, and cultural differences, and in particular emphasizing that different groups of people have unequal access to resources and vary wildly in their environmental impact.

Another aspect that is underdeveloped in the current articulation of the Anthropocene is its aesthetics. In a Kantian framework, the aesthetic experience is a state induced in the human mind upon observing an object—that is, once again the human is privileged as an active participant, while "the beautiful" is a mere passive object. What does it mean aesthetically to leave a Kantian framework of dualism behind and move towards a more phenomenological understanding of human-object and object-object relations? In what way does literature, for example, have the ability to model an affective interrelation between humans and the environment? Literature helps us understand that in the Anthropocene human emotions can be attributed to the environment and that people

suffer from environmental degradation. In poetry these imbrications are modeled as a poetic practice that shows how, faced with climate change and other daunting problems, humans and the environment alike are suffering. Such an approach provides a poetic understanding of what it means to live in the Anthropocene that is much more attuned with environmental concerns than the concept of the human geo-engineer and addresses the affective interrelation of human and environment from a critical perspective.

Another angle from which to approach the role of critical philosophy in the Anthropocene is to highlight the correlation between the human impact on Earth and the development of metaphysics. Humanity as a whole did not get us to this point, but rather Western civilization, and not all humans are affected equally by the consequences of environmental degradation. People and environments in the global South are affected on a much greater scale, and only a critical concept of the Anthropocene as an era in which already existing inequalities are widening and intensifying can address such an agenda for postcolonial and global environmental justice.

Such a critical concept can be a radical tool for critiquing the coherent narrative of progress that Western civilization has told over and over again, and it clearly and pointedly puts its finger into the folds and creases where the destructiveness of this project becomes apparent. Such a critical philosophy gives agency to nature and other victims of global economic capitalism but retains a normative postcolonial framework of global environmental justice by foregrounding processes of victimization, identifying the victims of violence, and providing a concept of critique that is interested in more enlightenment, all the while understanding and critically analyzing the social, economic, political, and cultural structures that stand in its way. It also provides an aesthetic framework for this critique by replacing the master narrative of progress and mastery over nature with a poetic practice that models human-nature interconnectivity. It is this combination of ethics (global environmental justice and responsibility for the future) and aesthetics (ecological/textual interrelatedness) that will define poetic practice in the Anthropocene.

References

Adorno, Theodor W. (1951) 1974. *Minima Moralia: Reflections on a Damaged Life*. Translated by E. P. Jephcott. London: Verso.

Alaimo, Stacy. 2010. *Bodily Natures: Science, Environment, and Material Self*. Bloomington: Indiana University Press.

Althusser, Louis. 1971. "Ideology and Ideological State Apparatuses." In *Lenin and Philosophy and Other Essays*. Translated by Ben Brewster. New York and London: Monthly Review Press.

Brown, Charles, and Ted Toadvine, eds. 2003. *Eco-Phenomenology: Back to the Earth Itself*. Albany: SUNY Press.

Bryant, Levi. 2010. "Onticology—A Manifesto for Object-Oriented Ontology, Part I." *Larval Subjects* (blog). http://larvalsubjects.wordpress.com. Accessed 9 January 2013.

Chakrabarty, Dipesh. 2007. *Provincializing Europe: Postcolonial Thought and Historical Difference*. Princeton: Princeton University Press.

Crutzen, Paul J., and Eugene F. Stoermer. 2000. "The Anthropocene." *Global Change Newsletter* 41: 17–18.

"Editorial Profiles" at *environmentalhumanities.org*. Accessed 11 September 2012.

Foucault, Michel. (1975) 1977. *Discipline and Punish: The Birth of the Prison*. Translated by Alan Sheridan. New York: Random House.

Gramsci, Antonio. 1971. *Selection from the Prison Notebooks*. Edited and translated by Quintin Hoare and Geoffrey Nowell Smith. New York: Columbia University Press.

Harmann, Graham. 2002. *Tool-Being: Heidegger and the Metaphysics of Objects*. Peru, Ill: Open Court.

Horkheimer, Max, and Theodor W. Adorno. (1944) 2002. *Dialectic of Enlightenment*. Translated by Edmund Jephcott. Palo Alto: Stanford University Press.

Jonas, Hans. (1979) 1984. *The Imperative of Responsibility: In Search for an Ethics for a Technological Age*. Chicago: University of Chicago Press.

Kant, Immanuel. (1781) 1855. *Critique of Pure Reason.* Translated by J. M. D. Meiklejohn. Online at Project Gutenberg. http://www.gutenberg.org/ebooks/4280. Accessed 9 January 2013.

Lailach, Michael. 2007. *Land Art.* Edited by Uta Grosenick. Cologne: Taschen.

Merleau-Ponty, Marcel. 1964. *The Primacy of Perception.* Evanston: Northwestern University Press.

Morton, Timothy. 2010. "Ecology as Text, Text as Ecology." *The Oxford Literary Review* 23 (1): 1–17.

———. 2012a. "Ecology without the Present." *The Oxford Literary Review* 34 (2): 229–38.

———. 2012b. "The Oedipal Logic of Ecological Awareness." *Environmental Humanities* 1: 7–21.

Nixon, Rob. 2011. *Slow Violence and the Environmentalism of the Poor.* Cambridge, MA: Harvard University Press.

Simmel, Georg. (1913) 2007. "The Philosophy of Landscape." *Theory, Culture & Society* 29 (7–8): 20–29.

About the Authors

Jens Kersten studied law at the universities of Heidelberg, Leeds, and Bonn. He worked as a postgraduate at Humboldt University Berlin, and was professor of planning and environmental law at the Technical University Dortmund and public law and economic law at the University of Bayreuth. Since 2008 he has held the Chair of Public Law and Governance at LMU Munich, and he was Carson Professor at the Rachel Carson Center in the 2012–13 academic year. His research focuses on planning and environmental law, bioethics and law, and the legal challenges of demographic change.

Reinhold Leinfelder is a geologist, reef geobiologist, museologist, and communication scientist. He is currently a professor of palaeontology at the Freie Universität Berlin; previous positions include professorships in Stuttgart, Munich, and Humboldt University Berlin, and general director of natural history collections in Munich and Berlin. From 2008 to 2013 he was a member of the German Science Advisory Council on Global Change (WBGU). Leinfelder was a Carson fellow in 2011–12 and is presently affiliated Carson Professor. His projects include the Anthropocene Exhibition at the Deutsches Museum, the Anthropocene Project at the House of World Cultures in Berlin, and "The Anthropocene Kitchen" within the Excellence Cluster "Image, Knowledge, Gestaltung."

Nina Möllers is the curator of RCC-related exhibitions, currently leading the project team of the Anthropocene exhibition that is scheduled to open in fall 2014. The exhibition is a joint project of the Rachel Carson Center and the Deutsches Museum. From 2009 to 2012, she was a postdoctoral researcher and coordinator of the BMBF-funded project "Objects of Energy Consumption" at the Deutsches Museum. She studied in Palo Alto, Tübingen, and Nashville, and received her PhD from the University of Trier. Her research interests are the history of technology; environmental, gender, and museum studies; and the American South.

Christian Schwägerl is a biologist and writer. He is the author of the Anthropocene book *Menschenzeit*, which has been published in German and French. In addition, he is the author with Andreas Rinke of *11 drohende Kriege: Die künftigen Konflikte um Technologien, Rohstoffe, Demographie und Nahrung*. Schwägerl is one of the initiators and board members of "The Anthropocene Project" in Berlin and an external curator for the forthcoming special exhibition on the Anthropocene at the Deutsches

Museum, Munich. Between 2001 and 2012 he was a staff correspondent for the *Frankfurter Allgemeine Zeitung* and *Der Spiegel* magazine.

Helmuth Trischler is the head of research at the Deutsches Museum, a professor of modern history and the history of technology at LMU Munich, and the co-director (with Christof Mauch) of the Rachel Carson Center. His main research interests are knowledge societies and innovation cultures in international comparison, transport history, museum studies, and environmental history. His recent publications include the book *Building Europe on Expertise: Innovators, Organizers, Networkers* (co-authored with Martin Kohlrausch).

Sabine Wilke is a professor of German at the University of Washington. Her research and teaching interests include modern German literature and culture, intellectual history and theory, and cultural and visual studies. Most recently, Wilke was involved in a larger project about German colonialism and postcoloniality and the question of comparative colonialisms, especially how Germany related differently to Africa and the South Pacific. With assistance from the Alexander von Humboldt foundation Wilke is now directing a transatlantic research network on the environmental humanities and is working on a new project on environmental criticism, in particular the overlapping concerns of postcolonialism and ecocriticism.

RCC Perspectives

RCC Perspectives is an interdisciplinary series of papers and essays in environmental history, environmental studies, and related fields. The papers have their roots in the scholarly activities of the Rachel Carson Center for Environment and Society and in current debates in society. They combine thought pieces and fresh empirical research, and they are designed both to further international dialogue and to inspire new perspectives on the complex relationship between nature and culture.

perspectives@carsoncenter.lmu.de

All issues of *RCC Perspectives* are available online. To view past issues, and to learn more about the Rachel Carson Center for Environment and Society, please visit www.rachelcarsoncenter.de.

Rachel Carson Center for Environment and Society
LMU Munich
Leopoldstrasse 11a
80802 Munich
GERMANY

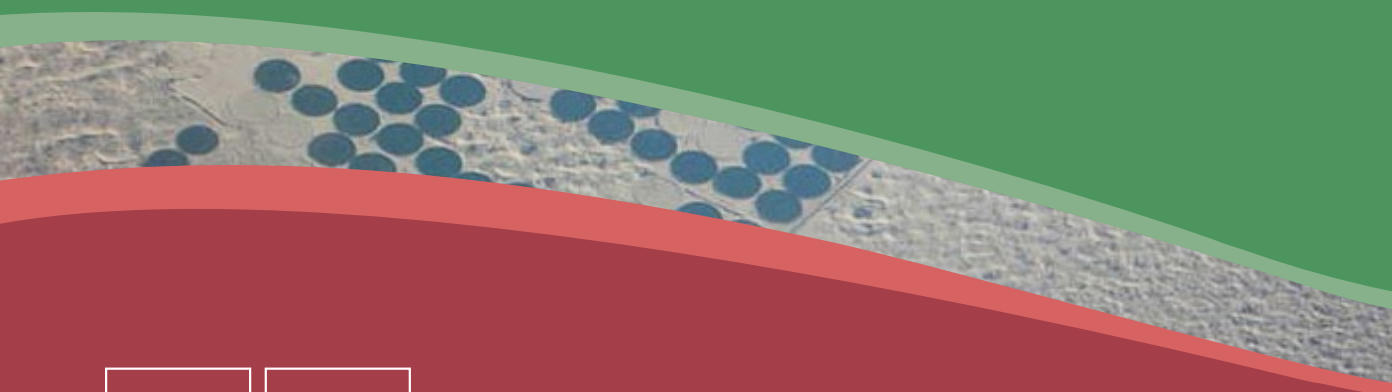
Design by Stefan Zinsbacher
Cover photo: Irrigation circles in the Sahara desert. Courtesy of Thctamm via Wikimedia Commons
Printed on recycled ENVIROTOP paper by PAPER UNION GmbH

ISSN 2190-5088

Munich, 2013

ClimatePartner°
printed climate-neutrally

Scientists have suggested that the effects of human activities are beginning to leave traces in the geological record, leading to the creation of a new geological epoch: the Anthropocene. But what does it mean to live in the Anthropocene? What are our responsibilities in a world where the boundaries between nature and culture are no longer clear? How do we visualize and teach the challenges of the future? The articles in this issue of *RCC Perspectives* reflect upon the ethics, aesthetics, and didactics of an "Age of Humans."



LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

Deutsches Museum

ISSN 2190-5088