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Introduction

The scales of experience: Introduction to the special issue *Experiencing the global environment**

Abstract

The Scales of Experience introduces the special issue *Experiencing the Global Environment* by focusing on three dimensions of the theme that are reflected to various degrees in the constitutive essays. First, the introduction highlights the links between the epistemological and political contexts of the historical constitution and development of the global environment (or global environments) in the earth and environmental sciences from the late nineteenth century to today. Second, it argues for a historical approach to the complex concept of scientific experience, whose mutable and contingent qualities are demonstrated by the contributions to the special volume. Lastly, the introduction presents one of the central issues to be tackled by the essays to follow: the development and, at times, the failure of strategies and technologies to bridge the seemingly incommensurate gulf between individual, localized experience and the all-encompassing scale of the global environment.

If we imagine ourselves in the Apollo 17 spacecraft, looking out through the porthole onto the sun-soaked Blue Marble floating in the far distance, we may begin to have a notion of what the global environment is: the whole assembly of oceans, continents, ice sheets, lakes, mountain ranges, and river deltas buffered by the atmosphere from the vastness of space surrounding the planet (Cosgrove, 1994; Lazier, 2011; Poole, 2010; Höhler, 2015; Grevsmühl, 2014; Grevsmühl, 2016). Upon our return to the surface of that very planet, we may have a more difficult time experiencing the globality of the environment. What seemed connected from afar dissolves into fragments and particularities from our vantage point as one minuscule part of the all-encompassing ecological system surrounding us. And yet, while we can only directly experience some of the local effects of global phenomena like anthropogenic climate change, most of us would readily agree that globalwarming is a material process with effects on a planetary scale. This awareness of the global scale of the environment is not based on the direct observation of phenomena, but rather on the analysis of data from around the world collected by earth and environmental scientists and their instruments, tools, and sensors. To make sense of this data, scientists have developed what we could call “experiential strategies,” such as interfaces to visualize data, and models and simulations to understand and explain temporal developments (Edwards, 2010; Gelfert, 2011; Wise, 2017).

Like the view from above, however, these experiential strategies require a certain detachment from our immediate surroundings, or our immediate environment. This poses an etymological conundrum, as the environment is, at least in its most literal meaning, what surrounds. In its earliest scientific uses, the thing thus surrounded was the single organism.¹ In the early twentieth century, biologist-turned-philosopher Jakob von Uexküll defined the *Umwelt* at the level of the individual and theorized how different animal species would experience their respective environments according to the physiology of their sensory organs (Uexküll, 1909, p. Uexküll, 1957 [1934]). By contrast, referring to the environment as a singular and global entity demands going beyond the particular setting and circumstances of any given organism. The phrase “the global environment” is thus not only of relatively recent coinage, but it is also at its root a somewhat paradoxical term (Ingold, 2000; Camprubí, 2016; Latour, 2017; Beck, Forsyth, Kohler, Lahsen, & Mahony, 2017).

The articles in this special issue seek to historicize, map, and ultimately bridge the apparent disjuncture between bodily surroundings and the global environment by investigating the various gradations of scale in which environments were perceived and measured: the papers here look at organisms (human and

* The essays in this special issue represent the final product of discussions at two workshops convened by the working group “Experiencing the Global Environment” at the Max Planck Institute for the History of Science in Berlin in 2016. We would like to thank all participants and extend special words of gratitude to Lorraine Daston and Hans-Jörg Rheinberger for providing both material and intellectual support for the working group; to Debora Coen for her insightful input during the authors’ workshop; and to Angela Creager and Etienne Benson for their perceptive comments and suggestions on this introduction.

¹ For a more nuanced and in-depth examination of the linguistic, historical, and philosophical dimensions of the “environment,” see: Canguilhem, 2001 [1952]; Dutreuil & Pocheville, 2016.

otherwise), fields, forests, colonies, continents, oceans, and tectonic plates, as well as at the whole earth. They show that the earth and environmental sciences, from ecology to Earth System Sciences, have operated in and with a number of intermediate geographical and temporal scales, while the globe, or the entirety of the world's various environments combined, became an important reference point for practitioners in a variety of scientific fields. The authors thus explore how experiences were produced, shared, overcome, lost, or transformed in the emergence of the global environment as a modern concept in the earth and environmental sciences. The various experiences studied in this issue go well beyond the usual suspects of visual models and simulations to include instrument readings, laboratory findings, and human and non-human sensory perception. Geographically and temporally, we also seek to unsettle established narratives often too focused on US Cold War science. Without losing sight of the importance of this period and its unique geography for the emergence of the global environment and the politics, science, and aesthetics associated with it, we bring globality back to the 19th century (and at times even further than that), including a diverse, if certainly not exhaustive assembly of views from America, Europe, China and Africa.

1. The stakes

The urgency of the topic is simultaneously epistemological and political. Activists often stress the difficulties of mobilizing people to take costly steps in the name of distant or large-scale environmental problems removed from their daily experiences. For instance, global warming is, by definition, a planetary phenomenon, but as Paul Edwards reminds us "no one lives in a 'global' climate" (Edwards, 2010, p. 4). And yet, humans everywhere on the planet are confronted by at least some of the local effects of global climate change and have to take the environmental, socio-cultural, and political specificities of their own place into consideration when trying to become active in counter-measures to the warming of the atmosphere. To overcome this rift between the global threat and the local context of each individual or group, it is common to underline the local effects of global developments, seeking to speak directly to the lived experience of targeted audiences (Dunaway, 2009; Jassanoff & Martello, 2004; Morton, 2013; Russill, 2016; Slovic, 2015). Two recent films directed by Jeff Orlowski, *Chasing Ice* and *Chasing Coral* make this argument explicitly and use tools like time-lapse photography and other techniques to help audiences experience global change and its consequences by visual proxy.

Of course, experiencing environmental degradation of planetary dimensions, and even fearing it as a danger, is not enough to trigger action to counter it. To a large degree, this is due to the unequal distribution of environmental impacts: the poor will more directly feel the effects of environmental degradation than the rich. But governments of poor (or relatively impoverished) countries might also favor short-term policies directed at alleviating local energy poverty, unemployment, or other social urgencies (Agarwal & Narain, 1991; Miller, 2004; Navroz, 2013). Those better off, even if well informed, might not be willing to lower their consumerist standards in favor of the greater good. Still others might feel that they can even obtain short-term benefits from rapidly changing environmental conditions: global warming, for instance, may result in new agricultural and thus economic possibilities in Greenland and Siberia, as well as in the opening of new trading routes through polar regions (Kennel & Victor, 2012). Global environmental change seems to play the same role in the world political order as the evercoming winter in the series *Game of Thrones*: a constantly present threat which will destroy the inhabited world and which is nonetheless too distant to bring together the different players who are busy fighting each other over that doomed world.

The mismatch between the local and the global scale is nevertheless more than a matter of education or self-interest. Ways of experiencing the global, by visual or other means, are by necessity always produced locally. There is neither a "view from nowhere" nor a "view from everywhere," and each attempt to see the global incorporates the particular local conditions and circumstances of the particular observer or practitioner. Again, this is true both epistemologically and politically. The development of the earth and environmental sciences is bound to particular knowledge practices and imperial backgrounds that at least partly account for the globality of their findings. This is not to denigrate and even less to censure the value and significance of these disciplines and their experiential strategies, but to acknowledge that the scales of their analyses are historically produced and contingent on their context. Deborah Coen has recently called for a history of "scaling" attentive to the work behind applying different levels of analysis and making them commensurable (Coen, 2016; see also; Reid, Berkes, Wilbanks, & Capistrano, 2006; Beck, Esguerra, and Görg, 2014; Oreskes, 2014). We thus have to examine each formulation of the global environment in its own context and allow for a complex and non-linear narrative of the scaling up (and often of the scaling back down) of the scientific vision (Fleming, Jankovic, & Coen, 2006). It is, however, also this historical complexity that enables us to analyze the formulations of globality as political processes. Just as there is not a single globalization, but multiple and often competing globalizations, there are also multiple global environments, produced by a variety of mediated experiences.

2. Varieties of experience

With this agenda in mind, this special issue uses historical case studies to elucidate the epistemological developments behind the rise of the global environment as a commonly used concept from the late nineteenth to the early twenty-first century. The common goal of the papers is to explore how far the global environment has exceeded the limits of our personal experience, but also how practitioners have attempted to overcome conflicts between scales in both material and conceptual terms. In order to further explore these questions, we first have to break them down into their constituent parts: what do we mean, on the one hand, by "experience" and its distinct varieties, and, on the other hand, by environment, globality, and the global environment?

Even just the attempt to define experience could already lead us down long and winding paths through the history of philosophy. Experience has been one of the key terms of epistemology, reaching back to Aristotle and, subsequently, the late medieval philosophers. John Locke's formulation of the role of experience stands as the basis for the empiricists' program: "Whence has it [the mind] all the materials of reason and knowledge? To this I answer, in one word, from experience" (Locke, 1690). Even philosophers opposing Locke's view defined themselves around this pivotal concept whether they were transcendental philosophers, neo-positivists, or phenomenologists, all had strong views on experience as the interface between minds (or bodies) and the world. They explored with subtlety the distinction and interdependence of two meanings of experience: as sense-experience (Russell, 1921) and as lived-experience (Bergson, 1922; Merleau-Ponty, 1945). When modern scientists spoke about their experiences of nature they referred to their sensations and observations, but also to their affects, to experiments, and to expertise (Daston & Lunbeck, 2011; Dear, 2006; Shapin and Schaffer, 1985). Historians, STS scholars, and philosophers are not alone in the exploration of perceptions and bodily experiences of nature. Psychologists (Bechtel & Churchman, 2002; Kaplan &

Kaplan, 1989), historians and anthropologists of the senses (Classen et al., 2014; Howes, 1991; Parr, 2010), media studies scholars (Farman, 2010; Halpern, 2015), feminist theorists (Haraway, 1989) and many others have contributed to understanding the role and meanings of experience in the sciences and in daily life. Rather than delving into this rich scholarship (but see Jeremy Vetter's article in this same issue), we will highlight two developments that are directly relevant to defining the problem that we are treating in this issue. First, it is widely acknowledged that the main theorems of various scientific fields are rather counterintuitive in that they depart from everyday experience, or even contradict it. Both practitioners and commentators even tend to partially define the sciences by their tendency to go beyond personal everyday experience, which is often taken as proof of their objectivity (Albert, 1992; Bueno, 2013; Daston & Galison, 2007; Porter, 2009). On the surface, the sciences of the global environment are no different: they, as well, give us insights into our surroundings that transcend individual perception. And yet they also derive data from our immediate and felt surroundings and attempt to give a description of them, while also claiming to inform our daily experience, at least on an intellectual level. The task, then, is to gauge how far the sciences of the global environment both depend on and go beyond everyday experience, as well as what new kinds of experience they produce along the way.

Second, and following from the preceding point, the articles in this issue approach experience not as purely personal or psychological but as profoundly historical, sociological, and mediated by technology. While Kant's critique of empirical experience consisted in invoking transcendental forms that would make that very experience possible, later scholars from a wide variety of traditions have pointed to more worldly constraints like human physiology, culture, language, and embodied practices as some of the forms shaping experience. But looking at experience as historical and collective takes epistemology beyond the realm of individual psychology and into the questions of ontology, of things being transformed, produced and reproduced (Daston, 2008). Thus, our volume extends the analysis of experience to animals, mechanical sensors, and economies of data exchange. In the papers to follow, the history of experiences of the global environment become a historical ontology of the rise of the global environment as a new entity or rather multiple entities.

Equally important for our analysis is that the meanings of the idea of experience have evolved together with those of cognates such as experiment and expertise, which also became pillars of modern epistemology. As shown by studies such as Simon Schaffer and Steven Shapin's *Leviathan and the Air Pump* (1985), the history of experiment and expertise alert us to the social and political components of what counts as scientifically relevant experiences and who is entitled to be an experiencing subject. As such, the different papers in this volume will often work with changing concepts of experience adapted to the historical categories deployed by the actors of their studies. What these historical actors shared were the perceived tensions between inherited notions of bodily and sensorial experience and the ever-increasing scales of their disciplines. This led them to often explicitly seek out practices of mediation, which are of special interest for the authors in this volume.

The articles thus expand on some of the questions around experience with empirical examples that illuminate the history of the global environment in the earth and environmental sciences from the late nineteenth century to today. This historical approach harmonizes well with a pluralistic approach to the sciences, which presupposes that the study of each discipline or cluster of disciplines may require different philosophical tools to understand epistemological processes. As the case studies show, our general framework enables us to approach very specific questions about the intersections and rifts between experience and globality. The authors share a common interest in the place and role of a wide variety of experiences within the earth and environmental sciences, be they human or animal, individual or collective, bodily or mediated. The volume as a whole strives to illuminate how different scales of experience have co-evolved with the scales of the environments as scientific objects. It does so through addressing three main questions: are experiences of the global environment possible and, if so, how and of which kind? Do these experiences matter, or are they even essential, to the sciences of the global environment? And lastly, how do scientific views of the global environment shape our experiences of local environments?

3. Perspectives

The problem of the mismatch between the scale of human experience and that of the global environment can be and has been approached from a number of different perspectives. Two extremes are represented by those who deny the possibility of any intersection between the realm of experience and the global, on the one hand, and by those who identify the global with a very real experience, perhaps the most real experience, on the other. In the first group are the declensionist narratives of loss that inevitably accompany new technologies and newways of structuring the production of knowledge (Sheehan, 2005). In the age of big science, electronic sensors and computer simulations, there is no lack of scientists and analysts who complain about a removal from direct experience of the field or their object of inquiry.

The second group includes visions of the earth itself as a sensorium or even a living being, as those explored in James Lovelock's Gaia Hypothesis. It would be a mistake to discard this theory as an arcane or even mystic approach, as it established some of the founding motives of Earth System Science and an important impetus for environmentalism as a political program (Dutreuil, 2016).² While this holistic approach to viewing the earth today usually no longer mobilizes the language of a sentient mother, practitioners in the earth and environmental sciences have covered the planet with sensors in a development that could be reinterpreted as the distribution of experience throughout the environment itself (Chuvieco, 2008; Gabrys, 2016).

The story of loss and the story of wholeness may be the two grand narratives about global experiences. Often in tension with one another, they echo throughout this special issue. The essays are also attentive to the wide array of positions in between, looking for histories in which the intersection of experience and globality was made possible. In this, we will be both building on and going beyond existing studies of technology and media as connectors between the scales of the body and the world.

While laboratories play a non-negligible role in these histories, the essays in this volume share a focus on the field as a space for the contemplation and conceptualization of environments on varying scales from the local to the global (Livingstone, 1984; Livingstone, 2003; Vetter, 2010). The contributions expand on the existing literature by discussing matters from the colonial context of "scaling-up" processes, which mirrored the political expansion of Europe into other parts of the world in a similar expansion of the scientific vision, to the relationship between observation networks and global frameworks in the earth sciences.³ Some of the authors place an emphasis on historical instances revealing dynamics of the relationship between individual experience and

² On the importance of images of the earth for the environmental movement, see also: Helmreich, 2011.

³ On the notion of "scaling," see Coen, 2016.

visions of globality. Others strive to unsettle the local-global dichotomy, shedding new light on the envisioning of intermediary scales and on counterintuitive processes of scaling in the field sciences. Under the umbrella theme of experiences of the global environment, the following essays blaze their own and novel trails, including the treatment of animal experiences, human bodies as sensors, the politics of data gathering, and the role of scientific theory in constituting global entities. The purpose of this volume is not to offer a definitive answer to the question of whether it is possible to experience the global environment. Our aim is rather to explore different possible meanings of the concepts of experience and global environments, and to highlight different attempts and approaches to experiencing the global. Rather than resulting in a unified and unitary answer, the individual papers thus highlight historically specific and contingent developments and patterns, while standing in close, and partly comparative, dialogue with answers and approaches offered by other authors of the issue.

Lino Camprubi's study on oceanography at the Gibraltar Strait opens the volume by showing how the discipline acquired a global outlook and how this process co-evolved with the seemingly contradictory development of an increasing focus on higher resolution and, thus, smaller measurements. As **Jeremy Vetter** argues in the following contribution, the different scales of representing the environment did not always mesh and could because of disagreements and disputes. As in the case of field work in the US Biological Service, the cosmopolitan knowledge of science tended to trump local experiences, which ended up as mere footnotes e both literally in the reports and figuratively on the margins of institutionalized science. A more successful case of working across scales features in **Etienne Benson's** essay on geomorphological research in the 1980s, which reveals how novel practices and cultural understandings of field work combined with new remote-sensing technologies to allow for a scaling up of visions of the Earth's surface.

The issue of mediating between scales already featured in latenineteenth- century geography and climatology. **Philipp Lehmann** examines the history of meteorological data gathering in the German colonies in Africa to examine how the encounter with non-European environments could both lead to more expansive visions of environments, and at the same time inspire practitioners to focus on the uniqueness and incomparability of individually observed and sensed physical phenomena. In **Elena Aronova's** contribution, the tools for observation and sensing were the animals whose physiological responses were used to predict earthquakes in the second half of the twentieth century. The essay traces how political and cultural circumstances and international scientific networks contributed to the emergence of a new branch of seismology that combined seismological with biological and behaviorist approaches. Looking at sensory perception as a collective rather than an individual practice, **Fa-ti Fan's** essay on animal earthquake sensing in China and beyond argues that a focus on the sensory, rather than instrumentally-recorded, data resulted in a more pluralistic understanding of earthquakes and a focus on larger-scale or macro-seismology. As yet another variation on the theme of sensory perception, **Angela Creager's** contribution on the rise of biomonitoring (what she aptly calls "the global environmental within") asks the intriguing question of how we should conceptualize experience of the global environment when dealing with bodily exposure that can be measured but not detected by the human senses.

Creager's essay is a possibly unexpected form of the common lament among practitioners of losing touch with nature. This dynamic has been around since at least early modern times, but it became even more anxious when numerical models, computers, and sensor networks took over some of the tasks of direct, individual observation. Some practitioners complained that the screen had replaced the field. Simultaneously, however, new notions of the sublime emerged around these technologically mediated approaches to global phenomena e from a sense of vertigo and cosmic insignificance when looking at the rising earth to a sense of wholeness when describing the biosphere as an all-encompassing ecosystem. Experiences of the global environment opened the way to new perceptions and aesthetics that are inseparable from current understandings of - and contentious debates about - the Anthropocene. And as the authors in this volume argue with a variety of historical examples, these experiences have always been pervaded by politics. Together, the papers thus show that a closer look at individual and collective experiences of the global can illuminate the role of humanity within this new era of the earth's history.

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