

CRITICAL DEBATE

# Politics of nature: East and West perspectives<sup>1</sup>

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## THE POLITICS OF NATURE: NEW AND OLD

Recent years have witnessed an increasing interest in ecological issues among thinkers concerned with cosmopolitics. Here I wish to offer a slightly different perspective on the politics of ecological issues by adding two lines of reasoning to the topic: one of them from my original field, science and technology studies, and the other from what I have called the anthropology of the moderns.

To begin with, speaking about a ‘politics of nature’ might appear simultaneously strange and obvious, terribly new and terribly old. On the one hand, that ‘nature’ in relation to ecological issues has become increasingly present in the political agendas of rich and poor nations is obvious to anyone who cares to read the newspapers. But nature has also entered the political realm in another and more troublesome sense. Until recently, we have been in the habit of saying that while politics is about conflicts, power struggles, ideologies, emotions, inequalities, and the distribution of resources and wealth, the turn *from* politics to the *natural* realm meant a move from endless conflicts to certainty, from human centered *passions* to object centered *reason*. This is no longer the case. What has happened in the recent past is that issues about natural entities—tigers conservation, the monopoly over rare earths, dam constructions, the planting of Genetically Modified Organisms (GMOs) cotton, genetics of race, alternative energy sources, and so on and so forth—no longer play the role of calming cold reasons, but have become some of the hottest topics of public controversies. It is as if nature and geopolitics had been conflated. We only have to think about last year’s climategate or the recent shaky deal in Cancun over non-binding CO<sup>2</sup> reduction to witness a political controversy about a formerly natural question: that of the climate itself. And yet, what could be further away from political

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arenas than the climate of the Earth? Who would have thought only 20 years ago that no political scientist could ignore the Earth climate system and all its uncertainties? Who would have thought that, in addition to constitutions, administrative law, and economics, he or she should be aware of the chemistry of high atmosphere or of the precise layering of Arctic ice cores?

However, this is not what is most novel or surprising. Who would have predicted that in turning one's attention to such new topics coming from scientific disciplines, one would have to *weigh* the relative authority of disputing and disputed scientists? This is really a novelty. Scientists no longer appear as a voice from nowhere mysteriously fused with the undisputable necessity of matters of facts. Each of us has to become aware of different cultures of science, different paradigms, different and often conflicting claims, instrumentations, research protocols, and field trial designs. In a strange way, we all have to foreground the complex *institutions* necessary for scientific productions. In earlier days, any politically astute commentator would know how to take into account the complex institutions of parliaments, of committees, of election, canvassing, campaigning, of corruptions, and media manipulations. But when he or she had to turn to the *results* of science—be it natural or social science—he or she would not have thought it required foregrounding the whole complex ecosystem necessary for the resulting fact to be produced. 'Institution' was a term used for representing *people*, not for representing objects and things. Who needs to take into account institutions when the truth of matters of fact are concerned? But today every one of us has to become a commentator, a critique, a judge, just as attuned to the complexity of political institutions as to the complexity of scientific productions.<sup>2</sup>

For this reason—the proliferation of scientific controversies, what I have called the shift from 'matters of facts' to 'matters of concern'—I think it is safe to say that the politics of nature is a new phenomenon and a rather troublesome one. What I named 'the parliament of things' 20 years ago is now almost fully operational, as we saw in Tokyo, Copenhagen, and more recently in Cancun.<sup>3</sup> In such a parliament, there are representatives who are spokespersons for people, for governments, for special interests groups, for lobbies, for climate models, ice cores, tiger preservation, genes, rivers, and soils. As I have shown many times elsewhere, the divide is not between science and politics but between trusted and not trusted representatives. What is sure is that the very notion of a *representative* government, or representative democracy, now includes the highly complex set up that represents non-humans as well as humans.

The situation is indeed novel and troubling, both for politicians who can no longer turn to scientists and experts to stop political controversies once and for all and who can't hide anymore behind the hard facts of science to disguise their arbitrary decisions, and for scientists who are suddenly forced to unveil the complex ecology that gives authority to their voices (and they have now to defend themselves against the accusation of being a special interest *among others* . . . ). There now exists, at least in dotted lines, a kind of global parliament for non-humans as well as for humans representing *special interests*, each representing their constituencies and no one being

able to claim to represent the general will or the common good once and for all. At least it is no longer possible to appeal *outside* this political arena, to nature and its laws as if it were a higher court and a higher transcendent authority, in order to stop political disputes and religious conflicts.

Simultaneously, no matter how novel this situation appears to be to us, it is certainly not the case that we have suddenly moved from a situation where nature was kept away from politics to a situation where it is now entangled into political arenas. In a very deep sense, politics has *always* been about things and matter. It has always been, to take up again the old and beautiful term rejuvenated by the Belgian philosopher Isabelle Stengers, a *cosmopolitics*, by which she means not an appeal to universality or to life in big metropolis, but a *politics of the cosmos*.<sup>4</sup> Indeed, I think it is important here to strike the right balance between those two Greek terms: ‘cosmos’ is what insures that politics will never be just for the benefits of isolated humans, and ‘politics’ is what insures that cosmos is not naturalized and kept totally apart from what humans do to it.

That politics has always been a cosmopolitics, that it has always been about landscapes, animal husbandry, forest, water, irrigation, about building cities, the circulation of air, the management of disease, in brief about cosmic and material forces, is so obvious in so many traditions that I do not have to belabor the point. This age-old connection does not need to be religious, it is also largely secular. If it is one of the beautiful results of Indian civilization to have elaborated extraordinary complex traditions and rituals around the entanglement of cosmos and good life, it is also true that a look at Marxist many schools would provide a wealth of the same linkages that have been established between material and social conditions. What counts is not if you are religious or secular, but if you manage to protect *humans* from being defined without the cosmos that provide their life support, and *nature* from being understood without humans that have collaborated with non-humans for eons.<sup>5</sup> Cosmopolitics is another word for materialism, as it were. But as usual the difficulty is to learn what is meant by the word *matter*. As we are learning or relearning very fast through the ecological crisis, it is very hard it seems to be a *materialist* for good.

As you may know, ‘cosmos’ in Greek means a *disposition*, an arrangement, a way to compose agencies, with the idea of beauty and ornament in addition to that of materiality. To this day, the trivial word ‘cosmetics’ maintains the value judgment that always go with the thought of a well-ordered cosmos. To speak of cosmopolitics is to say that the world has to be *composed*. To be composed and not to be unveiled, possessed, mastered, or abandoned for some other world, a world of outer space, of Pandora’s planet, or a world of beyond, a spiritual realm. I’d like to use the word *composition* as an alternative to *modernization*. Thus, as I will discuss in further detail later, we could say that the world has to be composed instead of having to be modernized.

But before we return to that, let me insist on the same point by claiming that while half of the inhabitants of the Earth have become inhabitants of cities, i.e. city dwellers, this should not hide the fact that we have all become *peasants* again. Yes! We

are relearning to be peasants just at a time when we thought we had migrated to cities for good. A farmer, a peasant is not only someone who lives *in* the countryside, he or she is someone who lives *off* the land. Think about it: in what sense are we *less* dependent of the land than before? My father who was a wine grower was by no means a peasant, and yet his whole attention was concentrated on the weather, on the rain, on the dangerous pests, on the earthworms, just as much as on the vagaries of the world market taste for Burgundy's fine wines. Similarly, today, we constantly and more than ever look out for the state of the weather, for the fragility of our ecosystems, for the coming of monsoons, for the pollution of our air, for the very stability of our soils, for the height of our seas, for the quality of our vegetables, for the safety of our soft drinks. To be sure, the *scale* of the territory has expanded, the size of our dwellings, the distance between the plot of lands, and our hands and our mouths, but it would be a great mistake to believe that we by moving from the countryside to the huge metropolis in fact had migrated from a land to *nowhere*.

Instead, we have been uprooted from one cosmopolitics to another. Go tell your representatives in Cancun that they are city dwellers who are now allowed to *forget* about air, soil, fire, and water. We are now farmers on Earth's troubled land, forced to come 'down to earth'. Here again, as always, modernization is not a movement that breaks radically with the past, but rather something that brings the past back with a vengeance in expanded scale and more entangled complexity. We left behind our little plot of land and our quiet and often stultifying village life and are now forced to consider the whole planet all over again. This is why I take the politics of nature, cosmopolitics, to be simultaneously a *new* phenomenon that forces everyone of us to reinvent politics and science in a new combination so as to absorb controversies about natural issues, and a very *old* fact of civilization that can be experienced through the many different traditions that have always rejected the idea of a human totally detached from her conditions of existence, from her life support, and from fragile artificial spheres.

In spite of this continuity between various types of politics of nature, some might still irresistibly feel that nature and politics are two *different* realms nonetheless. But why is it that it seems as such a surprise to modernized city dwellers to learn suddenly that they depend on levels of CO<sup>2</sup> for their climate, of planktons for their tuna meals, on rare earths for their computer chips? As good materialists, we might be surprised by the new associations in which we find ourselves entangled, but certainly not with the very fact of being entangled with things. The ecological crisis should come to us all—I mean us modernized city dwellers—as new avatars of the same old cosmopolitics, but not as a Revelation or an Apocalypse. So why is it that the ecological crisis appears to our cultures, not only as novelties but as scandalous obstacles in the way of our growth and development? Why are we surprised by what should be obvious: we live on Earth, where else would we reside? Thus, what puzzles me is how there can exist such a *disconnect* between, on the one hand, the size of the threat that is presented to us, and on the other, the laid-back, indolent, blasé attitude that so many of us take toward the duties of 'protecting nature' or 'saving creation'.

The argument I pursue here is that we do not possess the emotional set of attitudes to cope with this problem. This could be illustrated by comparing with war. Some say that we are actually at war, i.e. that the present threat is much more severe than the ‘old wars’, in fact, even more so than the nuclear war that has threatened human civilization—and still does, by the way—with annihilation. (Lovelock actually uses the war metaphor to explain why we can’t win against the ‘revenge of Gaia’: if we win we lose and if we lose against her, well, we lose too!<sup>6</sup>). And yet, if it were a war, we would know how to behave, how to define an enemy and a friend, and we would have the right set of emotions, of thrills, of fears. We would be mobilized, or at least we would know *what it is* to be mobilized. We have rehearsed it countless times since we were infants as if we had lived always in ‘war games’. With the ecological crisis, however, most of us don’t know what it is to be mobilized, emotionally committed, fully active firing on the front line, and so on.

Of course, some of us do know, but the problem of the Greens everywhere is that they seem unable to tap the right sources of energy and strike the right chord of the multitude. If we are so threatened, why is it that ecologically minded people constitute no more than a minority? I think most would agree that there is no comparison between the urgency of ecological concerns and the mobilizing energy of wars or, for that matter, religion. A threat to a temple? A blasphemy somewhere? Everyone is up in arms. Millions move like one single man. A threat to the Earth life system? A yawn, or a slow snail-like move to change our light bulbs. This is what I call the disconnect. How is it that we remain dumbfounded by the ecological crisis? Some of us are tempted by a retreat through ‘degrowth’ (*décroissance*), others claim that only religion can save us, still to others more technology is the only solution. And while all of those positions are entertained in rich nations and wealthy suburbs, the large part of the world’s population is still clamoring for decent housing and clean water, emancipation, growth, and development. Indeed, two claims are simultaneously true: there is a threat to the human life support at the same time as several billions of fellow humans have to be lifted out of poverty.

It is fair to say that modernization has *not* prepared us especially well to the impact of the ecological crisis. Rather, it seems as if the modernizing urge has made the modernized unable to prepare themselves for the necessary changes in the scale of their cosmopolitics. Instead of preparing themselves, they entirely forgot they would have to equip themselves emotionally, institutionally, and legally for the tasks of a politics of nature. In fact, to put it more bluntly, it was not only a lack of preparation, a sort of indolence, but an *active denial* that such preoccupation should even take place. ‘Emancipation’ for the modernizing activists meant that it was not only unnecessary but even *reactionary* to even think about the short- or long-term nature of our anthropic life support. In the powerful terms of the great German philosopher Peter Sloterdijk, humans were supposed to have moved ‘outside’, freed themselves from any attachment, and not to remain ‘inside’ any sphere of existence. This is what was meant by ‘emancipation’: to modernize was to move ‘out of’ old dwellings never to come back ‘into’ a new more fragile, complex dwelling.<sup>7</sup> Those who were resisting

modernization—and they were many, left and right, poor and rich—were always taken as a rearguard slowing down the inevitable frontier of progress.

This means that some caution is called for when using the word ‘progress’. This word does not necessarily mean that anyone progress ‘forward’, or looks ahead with eyes wide opened and careful precaution. Progress might also be blind, thus moving with eyes wide shut. In fact, I believe that the great paradox of the two centuries variously described in terms of industrial revolutions, capitalism, mechanization, or globalization is that while they were in effect rendering through each new innovation even *more* necessary a politics of nature, the net result was exactly the opposite; that is, the constant delaying and indefinite forgetting of the day of reckoning where emancipation would have to pay its full prize of entanglement. Instead of preparing for Gaia and taking her as the necessary consequence of our expanding energy, ingenuity, technology, and our own expanding numbers, we suddenly *startled* as if Gaia was suddenly irrupting as a total surprise and *in our back!* I have been very interested lately in this strange configuration that makes ecological concerns appear at the back of modernizers. Were they not supposed to be turned toward the *future?* Forward! Forward! Is this not in the name of this ‘*plus ultra, plus ultra*’ that Europeans have moved through and across the world? But if this were true, if they were really facing forward, then they *should* have met the consequences of their entanglements face on instead of waiting until the last 10 or 20 years to realize suddenly that they lived *on* planet Earth.

Hence, my suspicion is that the modernizers are not turned toward the future as I thought they were, and as the old cliché of ‘*hubris*’ has made us believe. They are more interesting than that. It is not hubris that makes them move but the escape from the past, a past to which they are totally fixated because they remain constantly terrified by being archaic, attached, and dependent. Indeed, this would explain why they keep living in *utopia*, viz. thinking of growth and development without attachment and entanglement, a dream of living in no man’s land. No wonder. If you think of it, it is completely impossible for someone who flees his or her past in horror—fleeing backward, that is—to simultaneously look behind the back for what is coming next, to prepare oneself for what is coming ahead. In my view, the moderns’ state of confusion in facing the ecological crisis, the lack of any full-blown politics of nature, proves that they have been the *least* future-centered of all people.<sup>8</sup> Had they looked ahead, they would have seen what was coming much earlier. This is also why modernizers are such bad indicators when the time has come to distinguish who is reactionary from who is progressive, who is archaic from who is modern, and what is moving backward from what is moving forward. Don’t ask directions from people fleeing backward to escape a horrible past while not noticing where they are heading and what is coming at them from behind. Don’t ask directions from people twice terrified!

## EAST AND WEST PERSPECTIVES

In light of this, one might argue that ‘we have never been modern’, which brings me to the topic of the subtitle, which states ‘East and West perspectives’, as if there was

an East and a West! Be reassured, I am not going to indulge into exoticism. I will not oppose ‘Western secular materialism’ with ‘Eastern wisdom’, nor contrast ‘Cartesian dualism’ with ‘Asian spirituality’. No, as an anthropologist I have always been interested in combating all exoticisms, and especially the one that has fell so hard on my European compatriots, namely *Occidentalism*. The ravages of Orientalism have struck very hard due to the difficulty of describing the so-called West without attributing to it virtues and vices it never had. In fact, the first exoticism was about the West—what they believed they were doing—and has only after struck on the ‘others’. Hence, Orientalism is in a way the exportation of Occidentalism.

So the first task for anyone engaging in the risky enterprise of comparing East and West perspectives is to *not* mess up the standard that is chosen as the baseline for the comparison. Unfortunately, the problem is that almost *everyone* has messed up the definition of the West by taking it as its face value, taking up its own Master Narrative about having been modern; a narrative suggesting that the West was the place where a ‘scientific revolution’ had occurred in such a way as to reveal the universal necessity of *nature*. It is my contention that this is the source of exoticism that would render impossible any cosmopolitics. I know I am treading on dangerous ground here and that the ugly head of ‘relativism’ might make you flee in panic. But bear with me a while longer.

This anti-Occidental argument is not a critique of science nor a flight from reason, but only an antidote against exoticism. It merely suggests that it is necessary to redescribe science and technology as they have been developing in the last three centuries without cutting them from the rich matrix in which they have grown. The reason why I am proud of my little domain of science and technology studies, is because it has provided the first antidote to Occidentalism by offering a redescription of science, reason, nature, and matter, which is just *as far* from celebration as it is from critique. It offers a view of science in action, freed from the vices and virtues that makes it impossible to compare with other modes of existence. From the Greek practice of demonstration—I am thinking here of Reviel Netz’s fabulous book<sup>9</sup>—to nanotechnologists’ manipulation of image—think of Lorraine Daston’s and Peter Galison’s recent book on Objectivity<sup>10</sup>—through so many revisions of major historical figures—such as Simon Schaffer’s Newton,<sup>11</sup> Mario Biagioli’s Galileo,<sup>12</sup> or my own Pasteur—a completely different narrative of what has happened under the name of the scientific revolution has revealed itself. None of those episodes is clarified, explained, simplified, or understood by saying that a modernist spirit has finally emerged out of its archaic premodern past. Of course, there has been many dramatic changes in cosmopolitics, such as a formidable amplification of the number of non-humans to take into account, and an amazing deepening in the intimacy of the connections between humans and non-humans. But these changes never meant an escape from cosmopolitics itself. Because where could this possibly be an escape to? To nature? To modernity? To emancipation?

This is not the place to review those changes, but let me make a few remarks. While the modernist narrative implied a move from the old archaic *cosmos* to the infinite *universe* (to use Alexandre Koyré’s title),<sup>13</sup> the alternative narrative that

I propose as an antidote to Occidentalism implies a move from a finite cosmos to another vastly enlarged but *still finite* cosmos. That is, from one politics of nature to another one. However, that we have moved from one set of finitudes to another doesn't mean that we are limited, since new sets of possibilities open, which require a very different set of attitudes regarding science and technology in order to adjust to this new (that is, old) finite cosmos.

It might be objected that it doesn't seem to make much difference which narrative we hold on to here. Indeed, I am well aware that these changes have been made explicit through the work of experts in history, sociology of science, and technology, which could seem to have no relevance at all except for specialists. And yet the first thing this revision of Occidentalism does is to pry open all the questions of West–East comparisons. By totally changing the baseline (e.g. the West does *not* consist in a modernizing front that could be defined by the naturalization of cultural traits), we get a different shibboleth, a different compass, which allows us to reopen all the questions of 'comparative' or what I have called 'symmetric' anthropology without having to lose ourselves in the vague reveries of Occidentalism. Such a shift in outlook would come handy just at the time when the ecological crisis strikes indifferently East, West, North, and South, and when former 'East' is now made of powerful nations that makes it increasingly difficult to fasten the old veils of Orientalism. What is the use of speaking of East and West at a time when 'BRIC' has become the name of a new power block? Now that the geopolitical playing field is *less* unequal, it might be time to abandon exoticism for good, since something entirely different from modernization has occurred. If 'we'—the former inhabitants of the former West—have never been modern, what has happened to them and to all of us? Certainly a very different story than that of being a divided soul between archaic and progressive tendencies.

There is also a more philosophical gain to be made by this change of baseline for East/West comparisons. The results of the little field of science and technology study are now resonating in extraordinary and unexpected ways with the politics of nature that we have to address. The key opportunity, as I see it, is that we are finally in a position to free the practice of science from the narrow constraints imposed on it by 'naturalism'. Indeed, this takes us back to the introductory note about the contrast between nature and controversies about natural entities, matters of fact and *matters of concern*, modernization and *composition*, to which I said I would return. To put it bluntly: 'naturalism' is not the only way to harvest the benefits of science and technology. Naturalism does not describe the way nature functions, but actually deeply transforms—not to say pervert—the practices of science into something entirely different: a world into which things have become objects (*Gegenstand* to use the German term). This is a point that is difficult to make within the present limited space since it could easily be confused with a critique of reductionism or even with an attack on objectivity and realism. But the point is precisely the opposite: a *realist* description of scientific practice would have to retain everything we care for in the urge for science but will not prematurely *unify* all its results as if the objects of science all resided in what my compatriot Descartes had called the *res extensa*.



In other words, naturalism is the premature *unification* of scientific laboratory practices into one continuous domain, or to use philosophical terms: a world made of Galilean objects moving into Euclidian space. The results of scientific inquiries are always located inside their life support; limited to a complex set of visualizing techniques; dependent on the know how of small numbers of specialists; linked to narrowly defined and slowly moving paradigms; extraordinarily sensitive to shifts in funding, ideology, and industry. To put it briefly, while any mechanism, any automatism in order to survive requires a subtle legal and human ecosystem, and science and technology are always supported by complex institutions and mixed in endless ways to the rest of politics, naturalism is the operation that stitches together some of the uprooted results and expand them into a realm of undisputable necessities producing long chains of causes and effects.

This argument is toxic if you take it as a critique of scientific objectivity or as a cliché about never ‘forgetting’ that humans cannot be treated as mere objects. But what I wish to say is something different, namely, that objects themselves, I mean non-humans, should not be treated as mere objects either. Matters of concern should not be degraded into matters of fact. The reason why people find it difficult to be a materialist is that we have confused matter with a highly idealistic definition of what it is; hence, the unrealistic realism that passes for a hard boiled scientific outlook and which is often nothing more, as I have shown elsewhere, than the confusion between *res extensa* and the *drawings* of objects on computer screens. The reason why the multiverse has been flattened or squashed into a universe is because, as Whitehead said, the process to know, to draw, and to visualize things has been confused with the ‘passage of nature’ itself.<sup>14</sup>

A world made of *matters of concern* is infinitely more realist, more objective, and more recalcitrant than an outside world made of *matters of fact*. For sure, the spurious continuity allowed by the illusion of a *res extensa* offered a quick fix to the crucial political questions of agreement and universality. Undisputable matters of fact seemed to offer a way out of all of our disputes by unifying the world once and for all. But it was making the world common much too rapidly instead of progressively *composing* the common world. As the adjective indicates the world has to be made ‘common’, which is something that cannot be made fast and on the cheap. This is not a ‘relativist’ point against universality, it simply says that universality is at the *end* not at the *beginning* of a slow and difficult process of composition that cannot take place without establishing *relations* among all the entities that participate in the pluriverse.

To return to the politics of nature, I insist on contrasting naturalism with compositionism because of a very important feature of controversies over ecological entities. They are not visible without the mediation of scientific disciplines. If the problems of the public, as John Dewey said, is to visualize through inquiries the unintended consequences of our action, it is extraordinary difficult to produce a ‘public’ concerned with ecological problems because of the enormous complexity, the long distance between causes and consequences, the lag time, the rupture in scale, and the erasure of national and administrative boundaries.<sup>15</sup> At every step,

in order to visualize the consequences, we need to go through some laboratories to learn new techniques, to be confident in the results of some instruments, and to appeal to some experts. The very extension of science and technology to the whole fabric of our existence does not prove that we are now finally moderns. Quite the opposite: we have now mixed humans and non-humans to such a degree that we need a completely new cosmopolitics to create the feedback loops that would allow us to feel the consequences of our actions and build a collective public; that is, to *collect* the public out of a confusing set of issues.

## NOTES

1. This paper was originally delivered as a lecture at the University of New Delhi the 6th of January 2011 under the auspices of the European Cooperation Program and at the invitation of Professor Thaphan and Gilles Vernier.
2. James Hoggan, *Climate cover-up. The crusade to deny global warming* (Vancouver: Greystone Books, 2009); Naomi Oreskes and Erik M. Conway, *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming* (London: Bloomsbury Press, 2010).
3. Bruno Latour, *We have never been modern*, trans. Cathy Porter (Cambridge, MA: Harvard University Press, 1993).
4. Isabelle Stengers, *Cosmopolitics I*, trans. Robert Bononno (Minneapolis: University of Minnesota Press, 2010).
5. Amita Baviskar, ed., *Contested grounds: Essays on nature, culture, and power* (Oxford: Oxford University Press, 2007).
6. James Lovelock, *The revenge of Gaia: Earth's climate crisis and the fate of humanity* (New York: Basic Books, 2006).
7. Peter Sloterdijk, *Neither sun nor death. A dialog with Hans-Jürgen Heinrichs*, trans. Steve Corcoran (Los Angeles: Semiotexts, 2010).
8. Bruno Latour, 'Steps Toward the Writing of a Compositionist Manifesto', *New Literary History* 41 (2010): 471–90.
9. Reviel Netz, *The shaping of deduction in Greek mathematics: A study in cognitive history* (Cambridge: Cambridge University Press, 2003).
10. Lorraine Daston and Peter Galison, *Objectivity* (Chicago: The University of Chicago Press, 2007).
11. Simon Schaffer, *The information order of Isaac Newton's principia mathematica* (Upsalla: Salvia Smaskrifter, 2008).
12. Mario Biagioli, *Galileo's instruments of credit: Telescopes, images, secrecy* (Chicago: The University of Chicago Press, 2006).
13. Alexandre Koyré, *From the closed-world to the infinite universe* (Baltimore, MD: Johns Hopkins University Press, 1957).
14. Alfred North Whitehead, *Concept of nature* (Cambridge: Cambridge University Press, 1920).
15. John Dewey, *The public and its problems* (Athens: Ohio University Press, 1927, 1954).