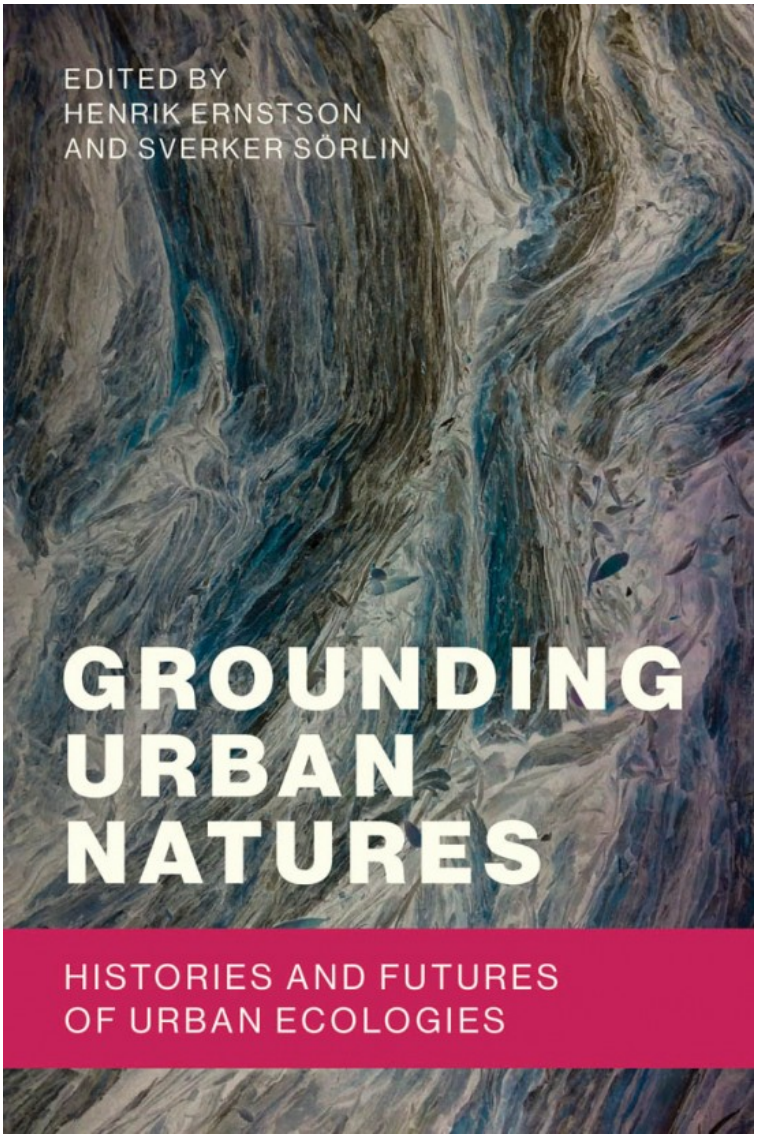

https://mitpress.mit.edu/books/grounding-urban-natures

5 Realms of Exposure: On Design, Material Agency, and Political Ecologies in Córdoba

Martín Ávila and Henrik Ernstson

A nine-year-old child in the Argentinean city of Córdoba is taken to the hospital and is kept breathing through artificial respiration.[1] A scorpion had crept in through the grate of the shower and stung him. Similar human-scorpion encounters have become more common over the last ten years and have prompted a public campaign on how to avoid being stung.

In this chapter we take an interest in more-than-human urban encounters of this kind. We want to understand what it means to share a place, not with cute, cuddly, or majestic animals that are easily visible, but with small animals, insects, and organisms that we instinctively fear will hurt us. The chapter therefore contributes to a growing literature that elaborates methods and frameworks to think about animals as fellow urban inhabitants. This has ranged from following the traces left by water voles and badgers in Birmingham in trying to upset expert ways of knowing the city;[2] to writing accounts that try to sensitize humans to how penguins and flying foxes experience the city of Sydney as "narrative subjects";[3] and, finally, to draw on media accounts of a tiger, an elephant, and a cow, which fled zoos, circuses, and slaughterhouses, to elaborate on the possible political agency of nonhuman animals.[4]

In relation to this literature, our contribution lies in approaching animals that we instinctively fear and, rather than using more traditional ethnographic methods, we use material design as a method of speculating about such more-than-human relations. Design has the advantage of sustaining affective, social, material, and political tensions and possibilities with species that we humans relate to. This chapter describes and reflects on an alternative shower grate that we designed with the idea of shifting the roles and relations between humans and scorpions toward cohabitation. A central aim is, therefore, to make urban dwellers more aware of the realms

of exposure that our everyday living produces among other creatures so as to better understand the political, metabolic, and affective implications of what it means to share a place.[5]

Indeed, the Córdoba situation is telling in that while we are aware of the state of the boy, who is fortunately stable and out of mortal danger, we know little about scorpions and why they increasingly end up in showers. To us, this silence on other-than-human urban dwellers hides fundamental questions regarding the historical distinction between humans and nature, and we see in material design and speculation a way to articulate richer notions of urban nature and urban ecology than what mainstream and scientific ways allow, from biodiversity conservation to the increasingly popular idea of ecosystem services.[6] This chapter focuses on situating our design intervention between species, and in particular to do so in Córdoba. We will start with a brief historical survey of modern infrastructure in the city and show how this relates to a more-than-human urban politics, which includes not only tiny creatures and intimate feelings of fear, but also city-wide metabolic processes. Building on this, we will describe our alternative design of a shower greate, which will help to rethink urban nature and its histories and futures.

Pollution, Appropriation and Response-Ability

In *Malfeasance*, Michel Serres offers the idea of a "natural contract" in which "appropriation [among living species] takes place through dirt."[7] If somebody spits in the soup, nobody else will eat it. The male tiger marks his territory with stinking piss. Across species, the animal body knows how to leave its mark in order to appropriate, to own.[8] However, with the rise of the sanitarian city and centralized network infrastructure from the late nineteenth and early twentieth centuries in Córdoba and other Western cities, how we view our dirt has changed.[9] In flushing away our bodily excretions—blood, urine, feces, semen—we are not any longer in direct contact with our waste, which still goes on to appropriate wider territories, ecosystems, even the biosphere, in our name.[10] While urban sewage and water networks significantly reduced the incidence of communicable diseases such as cholera from the late nineteenth century onward, these have also operated as a technology of abstraction, separating us from our pollution and its appropriations and carving out the space of our sanitized ordered

homes.[11] Through modern technical networks, we became cut off from the effects of our mode of living and how it affects other organisms.

In Córdoba, this history of infrastructural growth intersected with the lack of funds for the upkeep and maintenance of water-borne infrastructure in the older parts of the city. The mundane activities of showering, washing, and toilet-flushing slowly started to build up a fruitful, nutrient-rich habitat for scorpions and other organisms under the city. These organisms not only adapted but thrived in such sewage ecosystems. It is here, at this intersection between the sanitized modern everyday home (for humans), and the underworld habitat of the scorpion (and other organisms) that encounters between humans and scorpion take place, mediated by openings and orifices that connect with our bodily needs to extract dirt. The human-scorpion encounter at the center of our essay brings to the surface—or to put it more strongly, *performs*—how infrastructure is not only material, but also cultural, affective, and involving multiple species—a perspective usually not found in the vast literature on urban infrastructure and its histories.[12]

Our interest expands urban infrastructure studies to include ontological dimensions of urban ecologies and the life of other-than-human urban dwellers. In particular, we take the situation in Córdoba as an opportunity to explore the relations enacted when species meet and interact, and how their modes of being rub against each other. This means recognizing, with Donna Haraway, that a political dimension is inextricably part of any creature's mode of being. To explore the ontological *with* the political—the mode of being *with* how to live together—is , she suggests, "to become worldly and to respond"—that is, to somehow engage, recognize, and enrich our human ability to respond to others, for better or for worse, in a way that Harraway terms *response-ability*.[13] In this chapter we engage in such "response-ability" by looking at design in terms of our abilities to engage (or not) in and with the life worlds of other creatures.

Speculating through Design

Design plays a role in creating registers to acknowledge and change how the world "is" and how it "works" and, therefore, what it may become. Particular designs participate in creating *affective ecologies* whereby living creatures (including humans) can establish contact with one another, directly or

indirectly. Creatures can be rendered sensible to other life forms in concrete ways through design. In this sense, design can support an exploratoration of the ecological and political aspects of how we become part of the worlds of others, and how they become part of our worlds (while keeping in mind that these worlds are ontologically not identical).

As argued by Isabelle Stengers, in such situations when ontologically different worlds meet, speculation rather than description becomes necessary: "Description … relies upon the naturalistic assumption that there are things generalisable/universal and, hence, transferable and imposable. Rather than focusing on *what is* (as description does), speculation places the emphasis upon *what may become* within different suites of relations (or contexts) and from different standpoints."[14] A descriptive mode tends to assume a script and becomes overly dependent on anthropocentric metaphors, analogies, and narrative, which hamper the exploration (and composition) of more-than-human ecologies.[15] While design is not independent from language and symbols, it carries a certain material autonomy with which other organisms can interact. It is from this (material) interaction that some sort of interspecies communication can occur and a window can be opened to speculate *urban ecologies yet to come*.[16]

Designing with Other Creatures and Matters in Mind: A Design Brief

There are at least three guiding criteria that we applied in designing a device that can intervene in the human-scorpion encounter. First, the device should not remove the fear of the possible encounter between humans and scorpions, but rather stay with the fear and complexities of what it means to live in affective more-than-human ecologies. Second, the device should increase the range of ways that humans can engage with other organisms and their habitats (that is, increase response-ability). And third, the device should be capable of being scaled up from the individual situation to city-level metabolic flows in order to avoid or at least to lower the harm of human activity on other ecosystems. In the following sections we will go through how we think about design in relation to these points, before describing the final design proposal.[17] While we did design a prototype, we should emphasize that the aim of our material speculative approach serves to invite the reader to engage in an alternative reality, a fictive reality, since the design proposal is not a commercial product.

A design process works toward the creation of a *device* (a physical artifact, service, or a system) to deal with an identified situation.[18] Any device (etymologically stemming from *to divide*) arranges partitions—that is, it causes inclusions and exclusions in terms of perception, sensations, communication, and other possible interactions.[19] A doorknob is designed for the human hand to turn it; the human foot is excluded from interacting functionally with the door knob. Nonetheless, all devices have unintended and often unforeseen effects that arise from their own configuration. When we designed the car, we created not only a way to transport something from A to B, but also the car crash, and at a more global scale, increased carbon emissions in the atmosphere. In the case of Córdoba, its sewage system is part of a centralized design; it is a *strategy* for removing feces from thousands of homes that was rolled out by engineers over decades and that persists in the present. However, due to the continuous growth of the sewage and water networks and the lack of resources to keep up with maintenance during the last decades, these networks have started to attract species such as mice, cockroaches, and scorpions. One result has been a rise in encounters between scorpions and humans, particularly *Tityus trivittatus*, one of the most common scorpions in Argentina and one of the most dangerous to humans. For instance, during one day in November 2012, medical doctors tended to thirty-eight cases of scorpion stings in Córdoba, although the average monthly number is considerably lower.[20] In 2010, two young children tragically died after having been stung by scorpions inside their homes.[21] As a response to this threat, people pour toxic chemicals down their shower grates and toilets, trying to kill the scorpions and destroy their habitat.

If we study this quite nightmarish situation a bit more closely we start understanding the need for a design that does more than simply stopping the scorpions from entering the home. The device we are seeking needs to change relations more fundamentally and in ways that recognize the complexities we are part of. That is, the sewers not only perform "as planned," by transporting effluent from buildings, roads, homes, and so on, but also create alternative ecological niches for multiple beings.[22] Cockroaches and mice, two other common sewer inhabitants, find nutrients accumulated on walls, sedimentation of discarded food, blood, semen, and feces and other organic and inorganic substances that might be harmful *or* beneficial to the wide variety of organisms that come into contact with these systems.

Thus, under the city, and created by the city, there is a thriving habitat with beings that we usually fear and would rather not cohabit with. Furthermore, the scale of their habitat is so vast and these beings are so resilient and pervasive, that we need to contemplate what a responsive cohabitation could mean—not only in a negative sense, as a response to a "threat," but in the positive sense of caring for the liveliness of the environments we inhabit. To try to deny life to these ecosystems by continuously discharging pesticides that kill indiscriminately and poison downstream ecosystems is not sustainable in the long run. Thus, what we need is a device that takes us close to the scorpions and acknowledges their habitat and that of their fellow creatures.

This brings us to the second criterion that the design needs to increase the range of available responses between species. In the current system, the fixity and permanence of household shower grates are problematic. These are usually made of metal alloys and screwed in tightly, and in line with a modernist-Promethean logic of humans controlling nature, they not only perform a permanent physical boundary but also fix a cultural boundary between the sanitized home and the underworld of sewage as if the two had nothing in common. But we do have things in common; we know now that there has been harm on both sides. Consequently, due to the material and cultural fixity of the metal grates (as a design, as a device), it partitions, structures, and compels human behavior toward the simplistic response of discharging toxic effluents into the grate in order to kill scorpions, destroy their habitat and, along with them, a variety of other beings. The fixity seems to structure a relation of disgust, or at least one of ignorance of other life-forms and the effects of our human excretion of dirt. Are there alternative devices or designs that can alter this destructive tendency? Can a different device increase the responses by which relevant species can interact and compel a more curious attitude or a different human behavior toward nonhumans of the city? Can it widen the question of "who is here" in the city?

While avoiding the direct encounter between the scorpion and the human is central, the device should also scale up, as part of our third criterion, to address the wider metabolic flow of the city. Each individual household is a productive component of an urban metabolism through which materials and liquids flow and affects the city and downstream ecosystems. How can our alternative design support ecological considerations of energy, shelter, nutrition, toxicity, and so on for all humans and nonhumans that participate in these environments? As we will see, this calls for designing

an alternative shower grate that involves humans in communal gift-giving as part of contract of cohabitation. It is simply not enough to protect the human (or the scorpion); there needs to be a two-way relationship in which our actions as humans and scorpions contribute toward our *co*habitation, a recognition of being of the same city.

In this chapter we draw on these three criteria and use this situation of designing with "response-ability" to scorpions to reflect more generally on our relations with other beings. Following Haraway, we attempt at "staying with the trouble," not resolving the "problems" or neutralizing what may repel us.[23] "Staying with the complexities," as Haraway writes, "does not mean not acting, not doing research, not engaging in some, indeed many, unequal instrumental relationships; it does mean learning to live and think in practical opening to shared pain and mortality and learning what that living and thinking teach."[24] The central questions to which our method of speculation with design tries to respond to are: What role can design play in enabling us to cohabit with any beings, let alone those we dislike or that pose serious risks to our lives, without taking away the tensions inherent in that relationship? How can we cohabit with animals that we instinctively fear?[25] Before moving on to our alternative grate design, though, we need to engage with the scorpion and its "underworld" of sewage to better understand how they live and form part of food chains and relationships that sustain intricate and wider ecosystems.

Getting to Know the "Underworld": Waste for Some, Food for Others

Some of the oldest neighborhoods of Córdoba are the most affected by the presence of *alacranes*, as scorpions are locally known. The sewers in these areas were built with concrete pipes during the first four decades of the twentieth century. Although some private properties and households in these areas have made upgrades using more modern PVC (polyvinyl chloride) pipes, the public infrastructure connecting to them remains outdated. Over time these older parts of the system have accumulated sediment, and the differences between private (and new) and public (and old) systems are easily visible in online videos produced by sanitation companies that have been filmed inside the sewers using remote-controlled cameras.[26]

Here we find vibrant food webs with decomposers and detritivores such as bacteria, fungi, cockroaches, and other organisms that feed on, and thus break down, the sedimented food sources that have accumulated on the walls. Decomposers find fatty deposits, which they metabolize and convert

into proteins and fats to build their own bodies. In the process, the decomposers make available inorganic chemicals, which can be recycled as mineral nutrients for plants at the subsequent trophic level, further increasing the consumption of sediments. In this accidental relationship with decomposers and detritivores, there are positive effects for humans because what is waste for us can become food for them. On the negative side, some detritivores, for instance cockroaches, can become vectors for human disease. Additionally, as cockroaches feed and multiply they attract the top predator of this ecosystem—scorpions.

As scorpions surface from the underworld into human homes, some people get stung. Media coverage addresses the phenomenon each year during the critical summer months.[27] While there are several animals (spiders, snakes, and scorpions) in Córdoba that might threaten human lives with their poison, scorpion stings are the most common cause of hospitalization.[28] Studying the areas of the city most affected by scorpion stinging, we can identify key issues that contribute to their proliferation.[29] Factors include poor hygienic conditions, due mainly to the careless disposal of waste or the lack of infrastructure for its disposal; sewage exposure in public spaces; and the degree of vegetation in contact with sewage, where it encourages the presence of other species. Through interviews with specialists, and through hospital statistics, we have gathered evidence that most accidents with scorpions (more than 80 percent) happen in the bathrooms of private households. As a response to the awareness that household grates are the prime mediator of accidental encounters, people have been advised by the government to place smaller, denser meshes below the fixed grates to obstruct the entry of scorpions and cockroaches into the rooms (see figure 5.1).[30]

However, as we noted in the previous section, the fixed mesh does not decrease the presence of scorpions. Rather, it continues to silence the effect of human dissemination of dirt and noxious chemicals alongside their biological and ecological implications. Our alternative design must try to change this relationship and concretely acknowledge the ecosystem below, which involves taking a closer look at the scorpion.

Getting to Know a Fellow Species: What Is a Scorpion?

To get to know a different species requires the use of all senses—touch, smell, taste, sound, and sight—alongside more conventional studying. As an important part of the design process, for a year and a half the first author

Figure 5.1
A standard grate. Note the smaller plastic mesh placed underneath, recommended by local authorities, to prevent the passage of scorpions. Photo by Martín Ávila.

raised scorpions in multiple terrariums at home.[31] Living with scorpions helped him to study their behavior, but more crucially, in terms of the design process, this allowed him to gain firsthand experience of living with scorpions and to better understand the risks involved in cohabitation.[32] Notes were taken throughout this period, and questions such as "*What* is another living being?" and "What does it do, and how?" were asked with a view toward getting closer to the scorpion and understanding how this species may act and what it is capable of.

Bringing this experience together with more conventional studies, we can start writing a description of this species and how it lives. Scorpions are arthropods, invertebrates with segmented bodies and jointed limbs that form an exoskeleton made mostly of the fibrous substance chitin. They are efficient predators of insects and other small animals; their sting possesses venom, which is usually neurotoxic. To a human being, the sting from most of the existing species of scorpion (about 1,500) would hurt no more than a honeybee. However, twenty-five species of scorpion can be deadly to a human, in some cases capable of killing within seven hours. While the

evolutionary history of hominids (our history) dates back 28 million years (and that of primates about 75 million years), scorpions' evolutionary history dates back 425–450 million years.[33] From an evolutionary perspective, they have been quite conservative morphologically, while highly adaptive in their behavior, physiology, and ecology, which explains their ability to thrive in extreme physical conditions. As biologist Gary Polis writes:

> Some [scorpion] species can be supercooled below the freezing point for several weeks and yet return to normal levels of activity within a few hours. Other species can survive total immersion under water for as long as one to two days. Desert species can withstand temperatures several degrees higher than most other desert arthropods are able to tolerate.[34]

That scorpions can live in cities demonstrates such adaptive capabilities, but it also highlights our advance into their ecological niches. From the Spanish conquest to the end of the sixteenth century, the city of Córdoba expanded into the Suquía River, which was the natural habitat of scorpions (and other species).[35]

When it comes to feeding, scorpions use their sting to capture prey. They hunt at night, and although they have vision, vibrations from their prey guide their hunting while they orient and sense with their whole body. Scorpions do not sting unless provoked or if they feel threatened. Interestingly, our very condition as diurnal human animals has made it difficult to study scorpion ecology. It was not until 1954 when the use of ultraviolet light became common in field research that their nocturnal habits could be documented and studied (see figure 5.2).[36]

Given what we have learned, the idea of cohabiting with *Tityus trivittatus* might be discarded automatically because they are potentially deadly for humans. On the other hand, have they not already adapted to our cities? Are we not constantly expanding our habitats and displacing them and pushing them to adapt to a wide variety of artificial systems? Their adaptability and evolutionary history indicate that they are likely to continue to adapt to extremes. Combating them with noxious pesticides might be effective in the short term but ecologically devastating in the long term. Taking the human-scorpion situation of this essay as an example of the tensions involved in cohabitation, we now turn to our alternative design that attempts to acknowledge human and scorpion needs at several trophic levels.

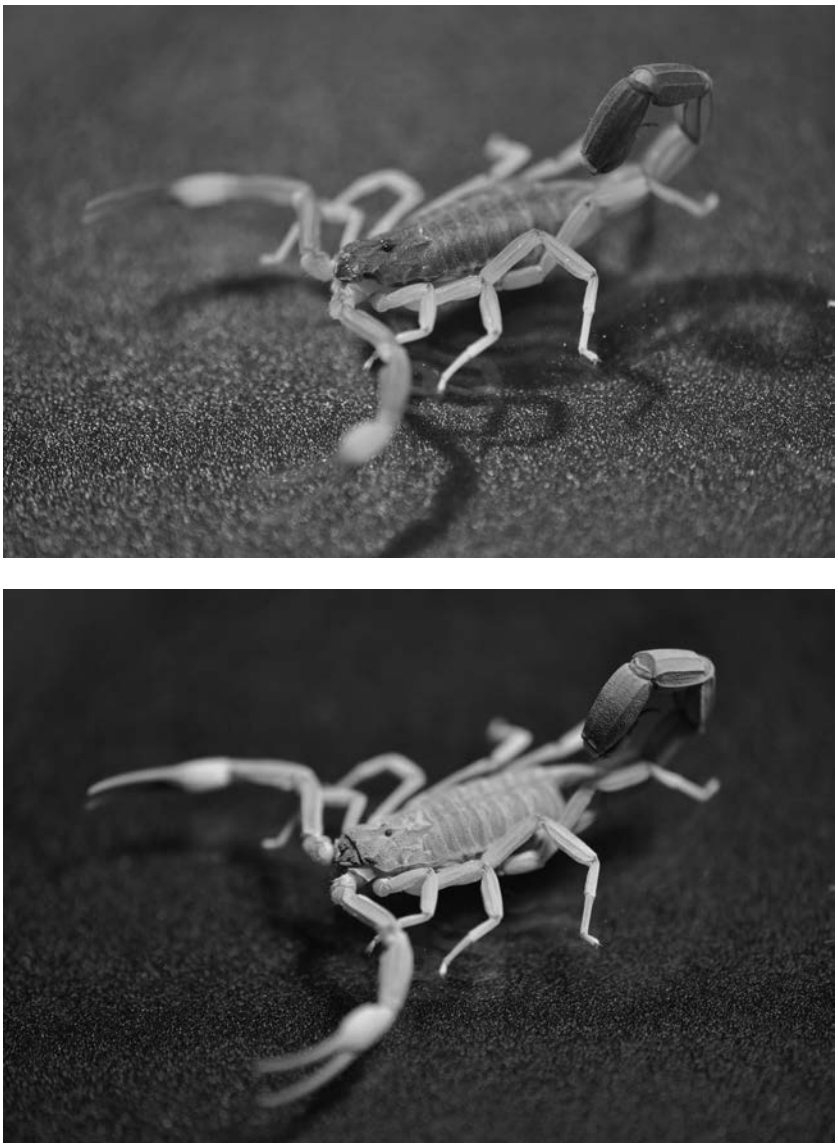

Figure 5.2
Tityus trivittatus in normal daylight (*top*) and with UV light (*bottom*). Photos by Martín Ávila.

Degradable Urbanism: An Alternative Design for a Shower Grate

The following describes our proposal for an alternative shower grate that intervenes in the present situation to speculate on cohabitation. It works in three main ways, which will be elaborated on below: to capture scorpions coming too close to human homes, seeking to change destructive human behavior that destroys habitats for creatures in the sewage, while biodegrading to feed the ecosystem below with nutrients. We first describe its functions and then compare it with present grates.

The photos in figure 5.3 are placed in the order of how the device would be used (see figures 5.3a, 5.3b, 5.3c, and 5.3d). The grate is internally covered with organic material such as bone meal (figure 5.3c). This attracts cockroaches, which, upon entering, get stuck in the adhesive that covers the upper and lower surfaces of the trap. The trapped cockroach sends out vibrations that would attract foraging scorpions that remain too close to the grate. If the scorpion enters the grate, it gets stuck on the same adhesive. In protecting the human home, the design recognizes that scorpions are hunters that do not eat dead insects or animals but are attracted by vibrations from prey.

However, while killing individual scorpions and cockroaches, the grate also operates to nurture and sustain the ecosystem below through altering metabolic and collective dimensions around the grate. When humans use the shower, the water flow will slowly degrade a white mineral layer on the grate's upper and visible side. Successive showers gradually reveal a darker layer underneath, which is made of a clayish mineral compound that becomes increasingly visible (compare figure 5.3a with figure 5.3b). The incremental darkening is a way for the grate to signal decay and transformation, and to warn humans of increasing "exposure," getting in closer and closer connection with the sewer. Thus, in contrast to the fixed metal grate between the "underworld" and us, this device operates to expose the sewer. It makes apparent the need to maintain the system with the intent of transforming our relationship to the "underworld" of sewage. Indeed, while *protecting* humans from dangerous individual scorpions, it also *attracts* humans to interact with the grate to sustain and intensify the relationship of affect and fear between the human home and the underworld of sewage.

In practice, once the orifices of a grate are almost completely dark (visually signaling "connection" to the sewer), it needs to be replaced (see figure 5.3d). This would happen every three to four months if the shower is used

regularly. The user could discard the grate, compost it or directly mix it with soil, or just throw it in the garbage bin. Because the grate's materials continue to degrade, it is up to the person discarding it whether it will contribute directly to some metabolic cycle nearby or not. Either way, the nutrients that have accumulated from the insects and arthropods caught on the sticky surface will ultimately contribute to some biophysical process. Meanwhile, during its useful cycle (when operating as a grate), the device complements natural processes by releasing nontoxic organic and inorganic materials and can thereby also increase the sense of connection *with* rather than division *from* those places and systems that we do not see.

Comparing current models of fixed grates with our proposed degradable grate, we note certain differences. The fixed grate expresses an ideology of strict separation between the sanitized home and an underworld that is to be kept at bay. Through it go water and other waste, never to be thought about again. Our alternative grate is less a separator than a "mediator" in Bruno Latour's sense of the word in that it transforms, translates, distorts, and modifies meaning, and, we might add, material relations.[37] It connects the human home and the habitat of others, and translates both into a new (co)habitat, a shared and wider ecosystem. The grate's appearance furthermore signals that it is in a constant state of change and disintegration, reminding us humans that we take part in and relate to other worlds that we might know little about, but that at times intersect with our world. Our grate thus differs from current conventional grates in terms of how it creates and changes relations at different scales and in the way that it changes metabolic cycles. In this sense, the proposal is normative. It seeks to produce a change in behavior in people, to compel the user to participate in a new constellation of relationships that certainly demand more than those relations upheld by a fixed grate. Indeed, users need to make a concerted effort to use the alternative grate for their own benefit, and the benefit of others. It implies a shift in lifestyle and provokes a change in perception of who or what we are living with.

More generally, the alternative grate demonstrates a design approach in contrast from standard anthropocentric practices. Although it aims to benefit humans, the starting and the end point is the condition of the wider ecosystems. Our focus is not only the well-being of individual humans, but also on the way in which the artifact (and the humans engaging with it) may participate in the life (and death) of others, so that the livability

Figure 5.3
(a) Grate while showering. (b) Opening the protective strip to install a fresh grate and replace the degraded grate. (c) The grate is fitted with a trap for scorpions and cockroaches. (d) Taking away the degraded grate. Photos by Martín Ávila.

Figure 5.3
(continued)

or vibrancy of the shared cohabitation or ecosystem can be sustained. The alternative design translates this commitment in metabolic terms through its property of being scalable to the whole city. If mass produced, the alternative design would be a basic, simple thing to buy and use. If it were to become popular and installed in thousands, maybe tens of thousands of homes across the city, these thousands of devices, replaced every third or fourth month, would degrade and erode and start shaping the metabolic system at the city scale.[38] Importantly, the design operates beyond the individual human-scorpion encounter in regulating what material components enters the biosphere.[39] It challenges conventional design that does not think with wider ecosystems and more-than-human ecologies. And it provokes thinking about what other designs could be replaced with alternatives that aim to affect the way we engage with beings that we do not normally consider part of our everyday lives.

Discussion

We recognize the playful dimension of our speculative approach. It is also highly situated because the alternative grate design really only makes sense in Córdoba. Therein lies our commitment to grounding urban natures, a practice that seeks situated responses, practices, and sensibilities. However, it is worth rounding off with a discussion of what this approach to intervene in the entanglement between different life forms could say about politics and the politics of urban ecologies. Our work tries to respond to how the simultaneous artificiality and wildness of urban nature demand a different way of thinking and practicing politics. Our cities, layered with attempts at modernizing and regularizing city life and city folk—and with a great variance across the world—hold in common the creation of quite fantastic ecologies, what some British geographes have eloquently phrased as the "dense comings and goings of urban life," a quickly shape-shifting "recombinant ecology."[40] Cities are unique high-energy environments, with a bundle of unpredictable inputs and fluxes of seeds, animals, and organic matters that are brought together in novel constellations with concrete and clay, with roads, cars, and electronic equipments. This makes for a strange place, and novel encounters are bound to happen. How are we as humans to organize our politics together with such wider, more-than-human communities with which we share the city?

The answer we are developing here attempts to stay localized and sustain dimensions of cohabitation that involve, among others, uneasiness, curiosity, fear, and fascination. Before developing this notion further, we can first contrast it with more mainstream natural scientific approaches that likewise deal with other life forms, in particular biodiversity and urban ecosystem services approaches. During the last decades, such work to change planning and human behavior to safeguard other life forms—often translated into policy tools such as habitat maps, biodiversity networks, or tables with contingency costs and trade-offs—typically reenact a separation of nature from culture.[41] They designate value to other life forms from within a Western and anthropocentric epistemological viewpoint.[42] While expressing care for other life forms, these ways of seeing and registering the nonhuman, risk continuing to mark a line between "nature" and "culture," between "them" and "us," just as the fixed conventional grate did. Here we have tried to move beyond, but also to complement, scientific registers—to make possible, perhaps—a richer, more affective connection between species. In short, to expand a multispecies sensorium of engagement and encounter. We can discuss this in three broader ways.

Affective Urban Ecologies

Mainstream approaches risk erasing or silencing vital dimensions of the ecologies that make up our habitat and worlds. By complementing centralized strategies and develop localized tactics, we have created a situated device that aims to integrate affective more-than-human ecologies as part of everyday urban life.[43] This means, on one hand, and as mentioned already, that the alternative grate in Córdoba would make little sense elsewhere—for instance in Texas, where snakes are the menace, or in Cape Town, where baboons cause problems. However, the practice of thinking design with (frightening) nonhumans can still travel and be translated into other alternative designs in other places.

Our proposed grate aims to enact affective ecologies in several ways. To start with, the darkening surface of the grate shows what is normally imperceptible—namely, the degradation and flow of materials from a building. As such it belongs more to the paradigm of food than to that of household fixtures or appliances. It thus helps us to perceive the material flows that are disseminated to the environment and to sense the scale at which other artifacts degrade and how they influence our habitats. This direct

relationship contributes to the possibility of increasing awareness of how the chemicals of hygiene products, cleaning products, and other products used at home influence the environments we inhabit by being disposed of into the sewers.

At a time when ecological crises expose the shortsightedness of various modes of human development, paradigms of design need to be disrupted through, for example, a redesign of everyday artifacts so that human exposure to other vital realms and species increases. The result would be a greater understanding of the complex ecological interplay in which humans are involved, including relationships that seem undesirable. In the process, we might also reach a more mature stage of reflection in producing the artificial, so that (design) proposals will consider the life cycles of products in relation to multiple beings.

This type of design practice also facilitates environmental education and participation. Instead of a centralized effort, such as a campaign in schools or workplaces about scorpions, educating becomes the province of nonhuman artifacts, in our case the biodegradable grate. This in turn implies that, as with any design, one would need to follow up on how the grate has been used to understand the different kinds of interactions, learnings, and changes it has, or has not, made possible.

Our proposal could thus be seen as part of recent efforts to reevaluate humanity's place "in nature." These range from scientific versions of Earth System Stewardship, or Gaia, with their associated global-legal regulations and imperatives, to posthumanist interventions to give voice to nonhumans, and further to decolonial thought, for instance through *Pachamama*, the term used by Andean pre-Hispanic cultures to designate human responsibility to all life forms. To various degrees, our mode of design can participate in discussions around efforts to materialize indigenous, postcolonial, feminist, and anticapitalist cosmologies that seek to reconfigure ways to be in the world.[44]

However, it is important to note that our *device* still *divides* and organizes an "above" and "below."[45] It does not try to arrange some kind of flat ontology where all is collaboration and bliss. Rather, it stays with the trouble and tension and actually tries to maintain a separation, an outside to its own relationality.[46] Thus, the grate is not a source of food for all cockroaches, but a trap for some of them and their predators, the scorpions. This can at first glance be viewed as a problematic example of cohabitation because

organisms are killed, which is not the case with the fine mesh wire recommended by city officials in Córdoba. However, while the official mesh is structured around (total) safety, our design stays with the tensions of cohabitation as it seeks to participate in rearranging more fundamentally humanity's place in nature. The routine action to replace the grate after it has disseminated its nutrients, after it has become darker and we feel exposed, brings our human collective life closer to the trouble by nurturing the species that threatens us while preventing the possibility of human death (by single individuals of this species of scorpions). The grate thus forms an explicit part of the metabolic flow of the city and operates as what could be called a *biosemiotic threshold*.[47] More plainly put, the alternative grate engages humans and relates them to what is under their feet, creating a connection rather than a disconnection and thereby making us sensitive to ecological interactions that have become invisible through current infrastructure. The device arranges *a higher degree of exposure* to worlds that we humans are not normally in contact with.

Realms of Exposure

Through the particularities of Córdoba, we have now learned about the divisions between the human domestic environment and the "underworld" of sewage. Our work through design has attempted to *expose this lack of contact* with basic processes that are vital to any ecological niche, including our own, which involves acts of killing (some) scorpions and cockroaches, while protecting and nurturing the collective of scorpions and other beings through the release of nutrients. This approach is consistent with Haraway's position that "asymmetrical" multispecies encounters[48] require more than caring and nurturing, but also, as we just noted, dying and killing:

> We are in a knot of species coshaping one another in layers of reciprocating complexity all the way down. Response and respect are possible only in those knots, with actual animals and people looking back at each other, sticky with all their muddled histories. Appreciation of the complexity is, of course, invited. But more is required too. Figuring what that more might be is the work of situated companion species. It is a question of cosmopolitics, of learning to be "polite" in responsible relation to always asymmetrical living and dying, and nurturing and killing.[49]

Our alternative design is a direct attempt at inserting a device into one of these many knots. As a mundane object, it actively participates at various scales along a natural-artificial continuum in the handling of feces,

urine, and other forms of (human) pollution to increase response-ability, our human ability to respond to others.[50]

By mediating between different realms of exposure, our work attempts to expose ontological aspects of design (preferences, behavior, and beliefs that seem unconscious and taken for granted) with the intention of increasing our participation in processes that might be difficult but are necessary to negotiate and enhancing our awareness of the (inarticulate) interests of more-than-human collectives. This invites a last speculation on including nonhumans or other-than-humans when thinking politics.

More-than-Human Political Assemblies

The alternative grate device can be said to operate at two levels: a micro-politics, practiced at the singular domestic level and coded with intimate feelings of fear and tensions; and potentially a macro-politics, operating on a massive metabolic and mass educational scale if it installed in thousands of households. These politics are enacted through the maintenance that the device requires, maintenance that is intentionally inscribed into it and that pushes humans to be part of something seemingly other (the life of sewage systems and scorpions, the areas where our bodily effluent is ultimately disposed of). The expiration date makes impossible the strict separation between spheres of dwellings.

These two levels of politics, while important, hide a deeper question of what politics means in a categorically more-than-human world. This question centers on exploring, in Aylon Cohen's words, "the boundary of the political community … between logical animals (humans) and phonic animals (nonhumans),"[51] and then considering whether our device can affect who or what has a voice in matters of common concern.

Following Jacques Ranciére, for instance, we could understand the scorpion as participating in "more-than-human political moments" as it breaks out of anonymity and disrupts the sanitized ordered home.[52] While Rancière has argued that political agency cannot be extended to nonhumans,[53] his theory of politics as *aesthetics* (relating to perception by the senses) is nevertheless strictly nonanthropocentric and opens towards more-than-human interpretations of the political.[54] His assertion that a political subject is "an agent of the division of the [political community]" lends itself to understanding the scorpion in political terms. Indeed, politics proper for

Rancière means breaking the normalized order of a policed space, one that allows only certain sounds and utterances to be sensed and translated into intelligible speech. If the alternative grate can assist in recognizing the new agent as a new "voice," then we could at least cautiously entertain the possibility that the device is participating in the making of more-than-human political assemblies. And, indeed, there are some indications that the grate could play this role through its own materiality.

It is the material design of the grate that produces accountability on part of humans to maintain the system. The materiality of the device also reformats the modern sanitized home so that the more-than-human "voice" of the underworld can be expressed, "heard," and sensed through the darkening of the (degrading) grate. If these conditions are not heeded, the grate will disappear and maybe the underworld will make itself heard again through a tragic and violent encounter with a scorpion in the bathroom. We here discover that at least part of the complex of living beings of the city's underworld can assert themselves as having, as it were, a palpable presence, which is one of the most basic principles of politics, the making-visible/sensible/hearable of new collectives.

Crucially, nonhuman beings' assertion of existing here among us (as an integral part of the city) bypasses the *representations* that we usually use to understand them (through, for example, scientific investigations, which take them as objects of nature, or by civic associations that want to protect wildlife and regard them as stakeholders in society). Rather, the device mediates between humans and the underworld of scorpions in such a way that scorpions' assertion of existing takes place through *their own modes of living*, not through representation by humans. The materiality of design, especially the view of a device as something that *arranges partitions*—that causes inclusions and exclusions in terms of perception, sensations, communications, and possible interactions—resonates strongly with Rancière's theory that political moments is about disrupting the "partition of the sensible."

If Rancière favors anarchistic rupture, liberal parliamentarian theory also provides speculative possibilities for our design approach. In Latour's elaboration of a "Parliament of Things," he writes: "The point … is that we don't assemble because we agree, look alike, feel good, are socially compatible or wish to fuse together, but because *we are brought by divisive matters*

—-1
—0
—+1

of concern into some neutral, isolated place in order to come to some sort of provisional makeshift (dis)agreement."[55] Perhaps our device could be a mediating artifact that could make possible more-than-human political deliberations. However, in contrast to Latour's rather expansive notion of a new Parliament, our speculation on scorpions in peoples' bathrooms has provided a much more intimate, everyday setting to think about more-than-human political assemblies and their constitution through the daily rhythm of life (and death) in the city.

Conclusion

This chapter started with an accidental encounter between a child and a scorpion in a bathroom. We used this situation to elaborate a design approach that opens toward a richer understanding of urban ecology and the natural-artificial continuum. Moving beyond traditional scientific approaches and descriptive social scientific research, we drew upon a speculative mode of research to explore urban ecologies yet to come, which the alternative shower grate materialized. As an artifact, this device invites human dwellers to stay with the tension of cohabitation, enrich their affective connections, and support wider metabolic flows while possibly encouraging the making of new more-than-human political assemblies.

We believe that our design approach to ecology could intervene in the current grave situation of unsustainability. The artifacts that surrounds us, from mass-produced domestic products to high-tech devices and big infrastructure networks, compel us to constantly leave our traces on every part of the planet, disseminating novel chemical combinations that do not take into account any other being but humans, nor any other being's chemical or metabolic flow. Because these chemical combinations have come into use at such a quick pace, the biosphere is unable to process them, leaving new, unknown, and harmful dynamics affecting many species, including our own. Performing as a border, the grate we proposed mediates these passages *between* different worlds (of the "human-home" and the "scorpion-underworld"), and it does so through its material components, with the hope of contributing toward a thinking, sensing, and doing that is life-affirming. Politically, this mediating border, this device, could embody the responsibility and *response-ability* that come with the acknowledgment of our part in a more-than-human world under stress.

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Notes

1. "En el hospital, un nuevo ingreso por picadura de alacrán: El Hospital de Niños recibió este lunes un cuarto internado por escorpionismo. Todos estables," *Día a Día*, May 1, 2015, http://www.diaadia.com.ar/cordoba/en-el-hospital-un-nuevo-ingreso-por-picadura-de-alacran. For all internet sources in this chapter, the last access date was September 18, 2018.

2. Hinchliffe et al. 2005; Hinchliffe and Whatmore 2006.

3. van Dooren and Rose 2012, p. 5.

4. Cohen 2015.

5. We recognize that our account from inner-city Córdoba in Argentina is situated within a Western-planned city and with households mainly connected to centralized infrastructure networks. This needs to be acknowledged in comparative research.

6. Henrik Ernstson and Sverker Sörlin, "Toward Comparative Environmental Urbanism: The Discovery of Urban Natures in a 'World of Cities,'" chapter 1 in this volume.

7. Serres 2010, p. 3. See also Serres's *The Natural Contract* (1995). For a critique of Serres's (2010) treatment of waste as appropriation through pollution, see Reno (2014). Drawing on biosemiotics, Reno foregrounds the *signals* that animals send out through their scat/shit and views waste as "signs of life," rather than waste as "matter out of place," and thereby affirms a nonanthropocentric framework. Our work resonates with his emphasis of the "liveliness of waste" (ibid., p. 19). For more, see note 47 on bio-semiotics.

8. This includes "certain plants," which at times "throw out little invisible jets of acid… and we all know that nothing grows in the frigid shadow of fir trees" (Serres 2010, p. 2).

9. Laporte (2002 [1978]) calls it the "history of shit."

10. For a historical account of infrastructure-led sanitarian transformation of Western cities, see Melosi (2000).

11. For Laporte (2002 [1978]), urban sewage and water infrastructure are tightly bound up with the historical rise in Europe of the bourgeoise class with its ideas of home, cleanliness, and morality.

12. In relation to sewage and waste, see Melosi (2000) and Karvonen (2011). For a contrasting context from Dakar, see Fredericks (2014).

13. Haraway 2008, 41. See also the early work from the 1930s on "Umwelt" by Estonian biologist Jakob von Uexküll (2010 [1934]).

14. The quotation is from Booth and Williams (2014, p. 183; emphasis added), with explicit reference to Stengers (2010).

15. See Maran and Kull (2014,p. 46), who explain that narrative description is inadequate for the description of ecological semiosis and communication between species: "There are no general purposes that non-human organisms follow, their intentions are local and they do not have the tools for temporal integration or meta-description. … A narrative description of ecological events is [thus] always metaphoric." This could be one critical conversation to have with van Dooren and Rose's (2012) approach to viewing animals as "narrative subjects." For a foundation into Maran and Kull's work, see von Uexküll (2010 [1934]).

16. See Ávila (2012) for several examples of how material designs set up different forms of communication (and symbiotic relations) between humans and other species.

17. We should clarify that the design proposal of the grate was not a commercial commission. Rather, the design was a material configuration and research element in helping to conceive human and other-than-human relations in alternative ways. As such, other socioecological and more-than-human situations had been studied before we choose this particular one with humans and scorpions.

18. As developed in Avila (2012).

19. As we develop in the last section, design can be seen as a device that arranges partitions and opens for an interesting conversation with Rancière's (2010) theory of politics as aesthetics.

20. Varying from year to year, the average number of persons getting stung by scorpions may be around two or three cases per day during the summer, with less

during the winter months. The source for this type of site-specific information comes from interviews we did in Córdoba but can also be found in newspapers and public reports; see, for example, "Se registran 40 picaduras de alacranes por día en Córdoba," *Cadena 3*, January 3, 2018, https://www.cadena3.com/noticias/sociedad/registran-picaduras-alacranes-por-dia-cordoba_110780.

21. See the e-forum Forotarantulas (http://www.forotarantulas.com/foro/index.php?topic=9659134.0) with links. See also "Una nena de 7 años murió tras ser picada por un alacrán en Córdoba," *Infobae*, January 8, 2017, https://www.infobae.com/sociedad/2017/01/08/una-nena-de-7-anos-murio-tras-ser-picada-por-un-alacran-en-cordoba/.

22. In a similar way, Hinchliffe and Whatmore (2006) observe that "cities are inhabited with and against the grain of expert designs" (p. 124).

23. Haraway 2010, 2016.

24. Haraway 2008, p. 83.

25. These questions form part of a wider project entitled Symbiotic Tactics (2013–2016) carried out by the first author with several designs including the alternative grate on which this chapter is based. These designs resulted from collaborations with many professionals and are based on research developed at the Multidisciplinary Institute of Vegetal Biology and other research groups within the Argentinean Research Council (CONICET). The design proposal part of this chapter was elaborated by Martin Ávila and Leonardo López using the project working title "Doomestics."

26. To view a video of the difference between private and public connections in Córdoba, see "Video inspeccion de conexión cloacal domiciliaria," YouTube, August 15, 2011, https://www.youtube.com/watch?v=59a0lm4TGuU. Note that the video is not from the specific neighborhoods being discussed in the main text. What is clear from the video and other reports is that there is a marked difference between (older) public and (newer) private pipelines, with thicker sediment in the former. From a traditional environmental justice perspective, this could indicate increased risks in terms of which type of household (class, ethnicity, and so on) scorpions are most likely to enter and cause harm in. We have found no secondary material to support such an environmental justice analysis.

27. For government information on scorpions and how to capture them, see "Alacranes: Cómo capturarlos en forma segura," http://prensa.cba.gov.ar/salud/alacranes-como-capturarlos-en-forma-segura/.

28. See Gastón Hernán Pepa, "Especies venenosas en Córdoba: 'No tema pero tome precauciones,'" *Córdoba Times*, November 13, 2013, http://www.cordobatimes.com/sociales/2013/11/13/especies-venenosas-en-cordoba-no-tema-pero-tome-precauciones/.

29. For editorial reasons we cannot provide the reader with all visual information we have available. For a map of the areas most affected by scorpions in households, see

Natalia Lazzarini, "Alacranes: Más picaduras en el centro y sudeste de Córdoba," *Día a Día*, October 1, 2015, http://www.diaadia.com.ar/cordoba/alacranes-mas-picaduras-en-el-centro-y-sudeste-de-cordoba.

30. See, for example, "Temporada de Alacranes: Consejos para cuidarnos en el hogar," Punto Sanitario, http://puntosanitario.blogspot.com.ar/2014/12/temporada-de-alacranes-consejos-para.html.

31. Martín Ávila and Leonardo López designed the alternative grate.

32. The design experiments were carried out with scorpions of several species (*Urophonyus braquicentus*, *Tityus trivittatus*, *Bothriurus bonariensis*), but focusing on the most dangerous for a human being, *Tityus trivittatus*.

33. Polis 1990, p. 2

34. Ibid., p. 3.

35. The city grew with colonization following a known pattern of Spanish conquistadores killing or forcing away indigenous peoples, including Comechingones, Sanavirones, and other groups. In 2016 the city's population was approximately 1.5 million people.

36. Polis 1990, p. 128.

37. Latour 2005b, p. 38.

38. Keep in mind that this metabolism is also shaped by many materials that lie outside the control of this device, including detergents, chemicals, cleaning implements, flooring and fixtures, and so on. These materials nonetheless participate by harming or benefiting some living systems at some ecosystemic level.

39. This aligns with Reno's (2014) biosemiotic analysis of waste, not as "matter out of place," but as "signs of life."

40. Hinchliffe and Whatmore (2006) quote G. Barker's (2000) notion of "recombinant ecology". For ecologists' treatment of species as urban adapters/avoiders, see the volume edited by Niemelä et al. (2011).

41. See Ernstson (2013) and Ernstson and Sörlin (2013) for studies of the politics of biodiversity mapping and ecosystem services in Cape Town. See Lachmund (2013) on the development of habitat maps in Berlin from the 1960s.

42. See Peder Anker's *Imperial Ecology* (2001) for the origins of ecology as a science that par excellance was developed to control environments and peoples across the British Empire. We also note that there are more bottom-up approaches to biodiversity; see, for example, Arturo Escobar's (1998) early call and useful problematization in the context of indigenous knowledge practices.

43. Compare with Hinchliffe and Whatmore's (2006) argument for a "politics of conviviality," but with more Deleuzian connotations. See Katherine Wolfe's (2006)

reading of how Rancière's notion of politics could communicate productively with Deleuze's idea of the "imperceptible" (in spite of Rancière's reservation of the political potential of Deleuze's philosophy).

44. See, for instance, de la Cadena (2015) and Haraway (2016), as well as Garuba (2012).

45. However, it does so by materializing an uncertainty principle, not knowing who or what is going to establish contact with it. More generally it is produced to degrade and disseminate organic and inorganic compounds with chemical compositions that are nontoxic to life forms

46. Swyngedouw and Ernstson 2018.

47. Throughout this chapter, we find several affinities with biosemiotic studies. In relation to how the alternative design fuses semiotics and metabolic flows, biosemiotician Jesper Hoffmeyer (2008, p. 345) suggests what he calls "semiotic fitness," arguing that "the magnitude of the flow of energy and the semiotic controls guiding the utilization of that energy… have constituted the pivotal points in both the historical process of civilization, and in the evolution of life on earth." This provides reasons for why our alternative shower grate can be understood as a form of "attunement" (Ávila 2012), a biosemiotic technology that is useful as a "tool for semiotic activity of every sort," such as for communication between humans, nonhumans, and all their combinations (Hoffmeyer 2008, pp. 343–344). For an explanation of open thermodynamic systems as life processes, see Schneider and Sagan (2005).

48. Haraway 2008, p. 81.

49. Ibid., p. 42.

50. Haraway 2016.

51. Cohen 2015, p. 277.

52. Booth and Williams (2014, p. 45) analyzed Australian wild fires "breaking free of wilderness and burning the settled lands of human habitation" as an example of a "more-than-human political moment."

53. When interviewed by Jane Bennett (2010, p. 106) on whether he "thought that an animal or a plant or a drug or a (nonlinguistic) sound could disrupt the police order [an important philosophical and political distinction in Rancière's thought], Rancière said no: he did not want to extend the concept of the political that far; nonhumans do not qualify as participants in a demos."

54. The authors of this chapter have debated whether Rancière's theory can be extended to include other life forms by focusing on his axiomatic criterion of *equality* as a condition for politics. Political agents need to rupture the policed order *in the name of equality*, uttering sounds that claim equality (Rancière 2010, 2014). An opening for an extension lies in Rancière's categorically aesthetic, and thus

nonanthropocentric approach to politics. It is rupture itself as a singular event that brings about a new state of affairs in which new speaking beings become hearable and intelligible, which in theory does not preclude any other life form. For concrete case studies in extending the political community via Ranciére, see Booth and Williams (2014) and Cohen (2015). For discussions about Rancière and political ecology, see de la Cadena (2015) and Swyngedouw and Ernstson (2018). See also Latour (1993) and Stengers (2010).

55. Latour 2005a, 13; emphasis added.

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