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Introduction

Nature and gardens in the history of science and technology and in garden and landscape studies

Maria Paula Diogo, Ana Simões, Ana Duarte Rodrigues and Davide Scarso

For centuries, science and technology have envisaged the relationship between humans and nature as unidirectional, nature being the passive protagonist serving as background for human agency. Doing justice to its dominant role, humankind has controlled nature through science, technology or other categories of knowledge, and as far as Western worldviews are concerned this asymmetric relationship has been at the core of the concept of progress and growth, which has framed Western societies.

When it comes to reflections about science and technology, history and philosophy of science and technology, among other disciplinary fields, have been questioning the absence of nature as a historical actor and narrative leader up until the twentieth century. Since the *École des Annales*, the 1960s debate on the culture–nature divide, and more recent scholarship on the entanglements between nature, technology and humans, have been under discussion (Bloch 1931, Febvre 1935, Braudel 1949, Kranzberg and Pursell 1967, Benjamin, 1986, Schatzki 2003, Williams 2010). They have been joined by the recent debates fostered by the concept of Anthropocene, which offer new avenues to explore nature's voice in the realm of history.

Starting from criticisms of the a-historicity often embedded in many debates on the Anthropocene, which use "we" and "us" as though human society is and has always been a homogeneous, flat and free-floating reality, they have called attention to alternative concepts to describe the "age of humankind", particularly by stressing the role played by capitalism, colonialism, imperialism and other forms of worldwide economy in the unbridled exploitation of natural resources. This perspective has been behind proposals to take a *long-durée* approach to deconstruct how a global technoscientific epistemology, based on the concepts of unlimited progress and growth, has converged to the *naturalization* of technology and the *commodification* of nature as structural building blocks of the hegemonic worldview which came to be associated with the age of the Anthropocene. Based on this hegemonic view, nature, as part of a larger domination-rooted type of society, became a human technoscientific construction (or destruction, for that matter), populated by mechanical bees, plastic

trees that soak up carbon dioxide, artificial islands, climate geoengineering, cloned animals and cyborgs, to name a few. For some, this paradox is now perceived as the "new normality"; for others, starting with the environmental scientist and journalist Bill McKibben, the dramatic erosion of the divide between nature and (human technoscientific) culture entailed the end of nature as an autonomous category: "we have deprived nature of its independence, and this is fatal to its meaning. Nature's independence *is its meaning* – without it there is nothing but us" (McKibben 1989, 58).

Simultaneously, gardens and landscapes have become part of the concerns of historians of science and technology, most particularly since the so-called spatial turn (Livingstone 2003, 2010). By calling attention to the situatedness of technoscientific knowledge,[1] in the sense that "scientific knowledge is a geographical phenomenon. It is acquired in specific sites; it circulates from location to location; it transforms the world" (Livingstone 2010, 18), Livingstone has urged us to take seriously the role of "landscape agency", and proposes to assess "the role of landscape in the generation and circulation of scientific knowledge claims" in the loose sense of allowing "space for the thought that nature has some part to play in the theories that are constructed about it" (Livingstone 2010, 9). In this context, gardens and landscapes emerged as particularly rich topics for further analysis. Two examples of scholarship in the field are Matteo Valleriani and Jochen Büttner's project on the Garden of Pratolino,[2] and Antoine Picon's chapter on the park of Buttes-Chaumont (Picon 2010). The Garden of Pratolino is one of the several private gardens of Tuscany that contributed to the renaissance of ancient pneumatics, thus bringing together traditional theories and new practical knowledge; the Haussmanian park of Buttes-Chaumont, built during the French Second Empire, seems closely akin to wilderness, but it is, in fact, a heavy user of technology, not only above ground, but also below surface (sewers, shoring). The Buttes-Chaumont park, with all its technological devices, is in itself a "machine à produire de l'urbanité" (Picon 2010, 30) that was built to serve the specific ideological commitment of the Parisian bourgeoisie. In both cases, the scientific and technical apparatus behind the gardens, as well as the agency that underlies their construction, are brought to the forefront, unveiling strong ideological, political and social entanglements.

But gardens have traditionally been approached in the disciplinary context of gardens and landscape studies. By exploring their relationship with landscape architecture, the study of their cultural and artistic significance has brought together social and cultural history, geography, aesthetics, technology (including horticulture) and conservation. More recently, scholarship in this field has bridged traditional research on garden and landscape studies with topics of the history of science and technology, as exemplified by the recently published volume on *Gardens as Laboratories. The History of Botany through the History of Gardens* (Baldassarri and Matei 2017). There is, therefore, a vast literature on gardens and landscapes both from the perspective of visual and artistic studies and from the standpoint of the history of science and technology. There is also

a growing literature on the Anthropocene and anthropogenic landscapes mostly from a scientific perspective or from eco-activism. We assess this trend in the following section.

Nature and gardens in the Anthropocene

While it could be said that announcements of the death of nature were probably "greatly exaggerated" it is not uncommon to see our present predicament described by sentences that include the term "doomed" (Hillman 2018, Malm 2018, Scranton 2018). Well before the word "Anthropocene" started its unstoppable march to popularity (according to Google trends, somewhere in the middle of 2011), in his celebrated *The End of Nature*, McKibben (1989) warned that human beings had become the "most powerful source for change on the planet" and explored the possible ethical implications of this awareness. He acknowledged, however, that declaring that nature as something separated and independent from human affairs has ended possessed a "clanging finality" that may give even more strength to the drive to control nature, through technics of genetic engineering or plans of planetary management. McKibben chose to advocate *restraint* as the real challenge, and argued that only by limiting "now, *today* […] our numbers and our desires and our ambitions" may we have the chance to dismantle the greenhouse we have built "where once there bloomed a sweet and wild garden" (McKibben 1989, 78).

Two years later, and seemingly as a response to McKibben, Michael Pollan argued that the "all or nothing" logic of wilderness ethic – whose adherents "are apt to throw up their hands in despair and declare the 'end of nature'" (Pollan 1991/2003, 194) – would hardly be helpful in most contemporary environmental issues, as they are irremediably ambiguous. Most often than not, the choice is not whether to intervene or not, but to be able to distinguish different degrees, methods and objectives of intervention, just as gardeners do. A gardener, according to Pollan, is a down-to-earth practical individual who "doesn't waste too much time in metaphysics" (227) trying to establish the ideal approach to nature, and "tends not to be romantic" (192) about it. As his/her knowledge comes from direct experience with natural processes, s/he does not picture himself/herself as working from the outside and, therefore, s/he "is not likely to conclude from the fact that some intervention in nature is unavoidable, therefore 'anything goes'" (Pollan 1991/2003, 194). Consequently, an environmental ethics that has gardening as its central metaphor and model allows for an open and frank discussion regarding the aim and methods of environmental interventions. Despite an unavoidable anthropocentric character, gardens foster a "give-and-take" and adaptable approach that escapes both a mystifying cult of wilderness and a biotechnology-driven hubris:

> Gardens […] teach the necessary if un-American lesson that nature and culture can be compromised, that there might be some middle ground between the lawn and the forest, between those who would complete the

> conquest of the planet in the name of progress, and those who believe it is time we abdicate our rule and leave the earth in the care of its more innocent species.
>
> (Pollan 1991/2003, 64)

At the time, in academic circuits, these issues were being discussed under the label of a "social construction of nature" (see Proctor (1998) and Hacking (1999) for early critical appraisals). At the end of the 1980s, with the dissemination of that intellectual atmosphere usually roughly termed "postmodernism", a whole literature concerning the constructed character of things thought to be "natural" (such as, and perhaps first of all, ethnic and gender identity) emerged. The main goal of the proponent of social constructionism was to pull the rug from under the feet of "essentialism" and show that the solid and immutable plane so often used as a framework for conservative – if not openly discriminatory – policies are the result of a more or less opaque texture of narrative contexts and power relations (see Burr (1995) for the first general introduction to the "canon" of social construction).

However, when it was time to move to the social construction of environmental issues (Bird (1987) is probably one of the first appearances), everything seemed more complicated. In order to defend nature, it may in fact be useful to know what it is. While, for someone fighting ethnic or gender discrimination, the constructedness of race or gender categories is usually a straightforward starting point, the idea that wild nature is a cultural product was inevitably bound to seem "a heretical claim to many environmentalists" (Cronon 1995, 69). While the critique of a certain cult of the wild, as that which is remote and pristine, was meant to reveal the ideological functions of the "deceptive clarity of 'human' vs. 'non-human'" and open up a "middle ground" (Cronon 1995, 85), it was received as a blow to environmental protection. For Michael E. Soulé, a biologist of conservation, nature became the object of a double siege (Soulé 1995). As if the global advancement of industrial exploitation, deforestation and pollution, the physical attack, was not enough, now a less visible and more insidious threat came from the "social siege" led by the "postmodernists" (epitomized, according to Soulé, by Haraway (1991) and Cronon (1995)) with the reduction of the idea of nature to social and historical processes.

A decade later, more or less unintentionally, the Anthropocene hypothesis dealt a new blow to the notion of pristine, wild or, in general, independent nature. For Crutzen and Stoermer, the new awareness of the geological scale of anthropogenic perturbations should persuade scientists and engineers of the need to "guide mankind towards global, sustainable, environmental management" (Crutzen and Stoermer 2000, 18). According to Peter Kareiva (2011), vice-president and chief scientist of The Nature Conservancy, acknowledging that human activities have altered the most basic life processes at a planetary level necessarily entails that conservancy and environmentalism must radically change their methods and objectives. For the advocates of "new-environmentalism" (Brand 2005, 2009) or "eco-modernism" (Asafu-Adjaye *et al.* 2015), the end of wild nature is no reason

for despair. Although there is no remaining corner of the Earth where we can find an uncontaminated natural environment, nature seems to be more "resilient" than we think. See, for instance, how "around the Chernobyl nuclear facility" (and as a matter of fact you can hardly find an environment more degraded than that), "wildlife is thriving, despite the high levels of radiation" (Kareiva *et al.* 2012). An environmentalism that is effective and up to date should therefore drop its old myths – the endorsement of the assumed frailty of the balances of nature, first of all, but also the reformist mildness of sustainable development – and face the harsh reality: "One need not be a postmodernist to understand that the concept of Nature, as opposed to the chemical and physical workings of natural systems, has always been a human construction" (Kareiva *et al.* 2012). If there is no wild nature to which to return, the only option is to move forward and aim for a "Good Anthropocene". A renewed and pragmatic environmentalism should engage with the most innovative capitalist enterprises in designing new ecosystems for a flourishing economy: "Nature could be a garden" (Kareiva *et al.* 2012).

In a much-discussed book, Emma Marris developed the notion that a "global half-wild rambunctious garden" would be the model best suited to our "post-wild world". In fact, the issue is not so much to abandon the notion of wild nature, but to bring it down the pedestal, and look at it as one possibility among others:

> In different places, in different chunks, we can manage nature for different ends – for historical restoration, for species preservation, for self-willed wildness, for ecosystem services, for good and fiber and fish and flame trees and frogs.
>
> (Marris 2011, 245)

The eco-modernism of the Breakthrough Institute sparked fierce opposition from varied perspectives. Evolutionary ecologist Tim Caro (Caro *et al.* 2011) published an inventory of the regions of the world where it was still possible to find intact ecosystems that had not been not significantly altered by human activities. Eco-modernism was also pictured as a neoliberal strategy to neutralize an already ailing orthodox environmentalism (Kingsnorth 2012, 2013) and, far from disputing it, finally validated the complete domination of the Earth by human beings (Crist 2013).

Gardens and human agency in the Anthropocene: this volume

Building on this ongoing discussion, this volume aims to contribute to the interdisciplinary debate on the Anthropocene by bringing together a group of researchers from the arts, humanities and social sciences around a common case study – gardens – that acts as the starting point for reflecting on the relations between human beings and nature.

It proposes to approach gardens in a renewed way both by building on the interplay of the conceptual frameworks provided by the history of science and

technology and garden and landscape studies, as well as by convening them as hermeneutic tools – not just a metaphor – to shed new light on the Anthropocene. It is also argued that a two-way reassessment is particularly fruitful, as one can simultaneously use the conceptual apparatus being developed within discussions on the Anthropocene to revisit and reassess former concepts associated with gardens and landscapes as localities where nature and culture converge and interbreed.

Gardens are used in this volume in the sense of designed landscapes of mediation between nature and culture as they embody different levels of human control over wilderness, define specific rules for this confrontation and stage different forms of human dominance. This volume's authors focus on ways of rethinking the garden and its role in contemporary society, and propose to use it as a crossover platform between nature, science and technology. Coming from different research areas – the history of science and technology, environmental studies, gardens and landscape studies, urban studies, and visual and artistic studies – they explore their joint potential, and specifically their ability to unveil various entanglements woven in the past between nature and culture, located at the antipodes of the simplistic assumptions behind the traditional nature–culture dichotomy, and they probe the potential of alternative epistemologies to get out of the predicament of fatalistic dystopias often revolving around the Anthropocene debate.

The road to this volume

As with most edited volumes, previous activities converged to the materialization of this book. From 2014 onwards, editors participated in different capacities in various Anthropocene Campi, a joint organization of the Haus der Kulturen der Welt (HKW) and the Max Planck Institute for the History of Science (MPIWG). These *campi* provided interdisciplinary *fora* for delegates of different ages, countries and areas of expertise to approach the topic of the Anthropocene in thematic and experimental seminars, whose deliverables have been feeding in part a lively webpage entitled the Anthropocene curriculum.[3]

The initial Berlin meetings (the Anthropocene Issue, 2014, and the Technosphere Issue, 2016) gave way to different worldwide offshoots, one of which took place in Philadelphia in autumn 2017. It was sponsored by the HKW and the MPIWG, and involved the collaboration of several institutions,[4] including the research unit to which all editors belong – the Interuniversity Centre for the History of Science and Technology (CIUHCT) – which brings together scholars from the two Portuguese institutions, the University of Lisbon and the NOVA University of Lisbon (both in Portugal).

Parallel to set the Anthropocene campi, in early 2016, the year prior to the Philadelphia meeting, the editors of this volume organized and/or participated in an international meeting held in Lisbon entitled "*Ars* versus *Natura*". The promise to explore the inputs from the history and philosophy of science and technology together with those stemming from gardens and landscape studies,

our various fields of expertise, guided us. Participants in the "*Ars* versus *Natura*" workshop were invited to take as their starting point gardens and landscapes and/or their representations in various media as special (depicted) sites in which nature and *ars* intermingled throughout time and place. Using a canonical definition of gardens as spaces where human beings operate artificially over nature, thus opposing wilderness, the workshop encouraged participants to discuss the historical origins of such dichotomy, probe its advantages and shortcomings, its limits and potentialities, explore the interconnections between its terms, and the constraints it imposes upon thinking about gardens and landscapes, especially when it comes to shed light on issues associated with the age of the Anthropocene.

Through these two different routes – the Anthropocene campi and the "*Ars* versus *Natura*" workshop – the editors of this volume became convinced that by calling attention to the contingency of historical events which came to confer a hegemonic status on technoscientific epistemology, together with the concomitant necessity to historicize its associated concepts – progress, growth, *naturalization* of technology and *commodification* of nature – a whole range of possibilities opens up to historical scrutiny, including the discussion of alternative epistemologies in illuminating solutions to circumvent a no-return situation, often convoked in the debates over the Anthropocene.

The structure of this volume

Thus, in this volume, we approach the classic topic of gardens and landscapes in a novel way, by interweaving different perspectives and connecting them to the ongoing international debate on the concept of Anthropocene. In Part I. "Rethinking the garden", we revisit gardens and landscapes, real or imagined, enriched by conceptual tools drawn from the Anthropocene debate; in Part II, Gardening the Anthropocene", we take the inverse perspective and explore how the Anthropocene debate has appropriated ideas and metaphors stemming from gardens and landscape studies, and how they guide us in probing various aspects of the Anthropocene. Finally, in Part III, "Staging the Anthropocene", we extend the approach of Part II to the Anthropocene as a performative study object.

Part I approaches urban gardens as tools for enforcing technoscientific-driven worldviews, bringing to the forefront the hidden dimension of gardens as tools to enlarge the scope of human domination over nature. Far from being "sanctuaries" of nature's agency, where the natural world runs freely, the gardens presented in the four chapters comprising Part I are human-tailored landscapes designed to serve specific goals. These manicured gardens – in a broad sense, as they include not only the obvious tidy and neat flower beds and lawn arrangements, but also artificially enhanced edible plants as well as controlled wilderness – obey the various rules and constraints, taming nature and forcing it to disclose its latent power. They are examples of human self-reliance embodying the essence of the concept of *Technik*, or in Heidegger's words, a refusal "to let earth be an earth" (Vinegar and Boetzkes 2014, 143).

In Chapter 1 – "Hygiene, education and art: Roberto Burle Marx's 1930s early modern gardens in Brazil" – Aline de Figueirôa Silva approaches the early public gardens designed by the Brazilian landscape architect Roberto Burle Marx in the 1930s, in the city of Recife (Brazil). Known for his outdoor landscapes that extended the concept of the architecture of buildings into gardens and other public spaces, Burle Marx designed green spaces as places to be experienced by humans from both an aesthetical and sensorial perspective, creating scenarios where tensions and drama played an important role. His themed gardens included both plants and animals and privileged indigenous vegetation species – he was one of the first to speak out against deforestation – better adapted to the Brazilian climate. The challenge which Burle Marx's gardens present to the reader and the reason behind their particular suitability to shed light on the joint articulation of gardens and the Anthropocene lies in their unique and challenging combination of tamed nature, non-organic and synthetic materials, and ecological concerns. In a way – and appropriating Oswaldo de Andrade's concept of anthropophagy (Andrade 1928) – Burle Marx "cannibalized" the human industrial footprint (skyscrapers, huge concrete-made metropolises and paved roads along the coasts) and, after distilling it, re-enacted it in his provocative gardens.

In Chapter 2 – "Between the nuclear lab and the backyard: artificially enhanced plant breeding and the British Atomic Gardening Movement" – Vanessa Cirkel-Bartelt explores the garden as a scientific laboratory in which both scientists and gardeners participated in evaluating the results of radioactive breeding. These technoscientific gardens, which bring together formal scientific expertise and the more hands-on knowledge of gardening, are discussed in the more global framework of technofixes and public opinion. Muriel Howorth and her British Atomic Gardening Society present themselves as a solution to the problem of food crises, which, in turn, resulted from the heavy and unbridled exploitation of worldwide resources. As in all technological fixes, radioactive breeding, and, later on, atomic gardens, were adaptations, temporary solutions to a problem, and as such did not tackle its true core. Although Howorth's proposals presage what became one of the more controversial and criticized technofixes – genetically modified organisms (GMOs) – they did not receive any strong criticism at the time. Most probably the small-scale and local dimension of the project did not make visible its externalities, its negative unforeseen or unintended consequences. Nevertheless, this singular case study nicely exemplifies the hubristic belief, which lies at the heart of the debate on the Anthropocene, according to which human beings can always fully control nature.

In Chapter 3 – "Urban utopias and the Anthropocene" – Ana Simões and Maria Paula Diogo discuss urban utopias put forward in the early twentieth century, contrasting Portuguese techno-scientific and British environmental perspectives. The traditional approach that conveys a dichotomous perspective between environment-driven and industry-driven utopias is replaced by a new interpretation grounded on the concept of Anthropocene. What is at stake in this chapter is not the discussion of the usual ideological differences between

Saint-Simonism and Georgism or between industry and land, but the call of attention to their shared vision of nature as a central tool for solving problems, mostly in the realm of health and hygiene. The "engineered cities" of Melo de Matos, Fialho de Almeida and Ebenezer Howard use gardens and green landscapes not per se, but as part of a wide concept of sanitation infrastructures that counteracted the unhealthy life in overcrowded cities. They acted as buffer zones to absorb the smoke and other airborne pollutants created by industry, keeping workers healthy. The main concern of Matos, Almeida and Howard was people, not nature; nature's importance was subsumed under human agency.

This rationale extends to Chapter 4 – "Shaping colonial landscapes in the early twentieth century: urban planning and health policies in Lourenço Marques" – by Ana Cristina Roque. European gardens in African colonial settings acutely reveal how anthropogenic landscapes convey specific ideologies and assert human dominance over natural and human landscapes. The greening of colonial territories is a particularly rich topic to discuss dominance as a multilayered concept and to take a fresh look at the contributions of social ecology to the Anthropocene debate. In Lourenço Marques (now Maputo, Mozambique), taming nature by draining swamps and imposing a disciplined European order in gardens was, in fact, only part of a larger system of domination grounded on economic and political goals. As other large technological systems – railways, roads, harbours – urban infrastructures of sanitation (gardens included) were tools for managing colonial territories in a growing global economy. Within this framework nature became a resource to assist social domination. The gardens in Lourenço Marques were part of a hygiene policy that aimed to both keep mosquito populations low (to combat malaria) and hide the native populations away in the suburbs, shaping a segregated "white city" that embodied the idea of progress and civilization advocated by the European colonial system.

Part II – "Gardening the Anthropocene" – approaches the garden as a metaphor to Planet Earth, proposing a renewed insight into the influence of the Anthropocene on the planet and on how gardeners' attitudes and expertise can offer effective alternative solutions to it. It presents on the one hand a more theoretically oriented approach to the concept of the garden, moving from the idea of an artificialized piece of nature around a house or in an urban plan to a planetary scale, and on the other hand raising a set of questions around the moral and professional scope of the gardener's work. From the idealistic visions of nature free from human agency to the real projects of reversing desert-like regions, "Gardening the Anthropocene" brings the gardener's rationale to the question of how humans should use the planet, offering a cutting-edge perspective on the co-construction of nature and humankind and its impact on future generations. In a nutshell, "Gardening the Anthropocene" points to new paths to overcome the human/nature dichotomy by entangling ecosystems and social formations.

In Chapter 5 – "From *Pairidaeza* to Planet Garden: the *homo-gardinus* against desertification" – Ana Duarte Rodrigues approaches the garden through the conceptual framework of *Pairidaeza*, the ancient Persian garden, taken to be an

enclosed space separated from wild nature and artificialized through human agency. She argues that the garden metaphor gained momentum as Planet Earth became threatened by the unrestrained use of its resources, a menace epitomized and popularized by the image of the Earth seen from the Moon as a fragile and finite planet. This chapter champions the philosophy of the gardener and his or her lifestyle against the *homo economicus* who tries to foster steady use and profit stemming from (unrestrained) consumption and production. The topic is addressed through several horticultural projects developed to fight desertification. The patient work of the gardener who planted trees as illustrated in the 1953 fictional story by Jean Giono, *L'homme qui plantait des arbres* [*The Man Who Planted Trees*], offers guidelines for analysing human beings' ability to change the landscape and its impact on social transformations. Thus, in this chapter, the gardener's attitude on nature abides by the good Anthropocene, and guides the discussion of real cases that evoke Giono's tale, namely the one of men who planted trees and operated an environmental and social transformation in the very precise localities of Burkina-Faso, or at a continental scale, the construction of tree curtains along thousands of kilometres to stop the process of desertification in North America, China and Africa.

In Chapter 6 – "From *Homo faber* to *Homo hortensis*: gardening techniques in the Anthropocene" – Astrid Schwarz focuses on the potential of gardens, garden practices and gardeners' values to overcome planetary destruction in the Age of the Anthropocene. The gardener is presented as an actor capable of experimenting with nature, thus embodying a specific type of *Homo faber* whose expertise is required to deal with the negative effects of the Anthropocene. *Homo hortensis* (the gardener), just like *Homo faber*, answers the "how" questions, thus fostering efficient and practical solutions to real-life problems. Gardeners have always privileged nature and space management, but recent gardening trends opt for making the best of their spatial settings, cooperating with nature, and respecting its cycles and rhythms. Therefore, *Homo hortensis*' attitude is not only embedded in values of care, esteem and survey, but also of adequacy and sustainability. Moreover, the author highlights the expertise behind various gardening practices, such as seedling, grafting, fertilizing, irrigating, as a source of inspiration for geo-engineering to match UNESCO's goals. In addition, gardening embodies a certain kind of morality, of perseverance and of values of confidence and hope for the future – subsumed in the wisdom behind the act of planting and the ability to wait for (uncertain) results that are decisive – to be confident about the possibilities offered by the uncertainties of the future. Finally, this chapter discusses how gardening can be a metaphor for "laboratory life", envisioning gardeners as the "new scientists" who control the co-construction of nature and human beings so as to secure a better life on the planet.

In Chapter 7 – "The distant gardener: remote sensing of the planetary potager" – a metaphor similar to the "Planet Garden" is used by Nina Wormbs and Johan Gärdebo. By opting for "planetary potager" rather than "Planet Garden", the authors emphasize the central role of the land as the source of humanity's livelihood and argue that Planet Earth is to be taken care of by its

inhabitants as their vegetable garden. As such, they emphasize how the high technology of remote sensing was used to map the resources of the planetary potager. However, this research proved that fieldwork is indispensable, especially when the environment is more heterogeneous than expected. In view of this, the local became essential to solving global problems and once more the garden's scale becomes central to the authors' goals. From local to global and back to local, human agency on the Earth at a global scale is envisioned through spatial technology but also enables one to tackle horticultural techniques used *in loco* to inform and reframe planetary technologies. As such, this chapter provides insights into the capacity of science and technology to deal with surveys of planetary resources as well as with environmental fragility by adopting gardening and the gardener's attitudes and expertise.

Finally, in Chapter 8 – "Resistance in the garden: nature and society in the Anthropocene", Davide Scarso offers an overview of the Anthropocene's state-of-the art bibliography and compares two case studies addressing ways to surpass the classical dichotomy between nature and culture. Taking as a starting point for his reflection the utopic project of the "sustainable Half-Earth system" proposed by the American biologist Edward O. Wilson, Scarso criticizes the dichotomy of human beings from nature as impractical. Moreover, the nature–culture dichotomy neither fits nor provides answers to the dark side of the Anthropocene, since the dominance of human agency over the planet implies an entanglement of nature and humanity's imprint. Scarso also contends that the Marxist dialectical materialism of the Swedish historian Andreas Malm in *The Progress of this Storm* does not offer better or more practical solutions than those proposed by Wilson. Focusing on the segregation of nature and society, Malm argues that their combination and the concomitant blurring of their boundaries is a disaster for humankind. Although recent data on global ecosystems urge humanity to find new models of development, both Wilson's and Malm's proposals based on the separation of two poles, whether nature–culture or nature–society, do not provide answers to the planet's problems, since nature, culture and society are irremediably entangled components of Planet Earth.

In view of this, the metaphor of the garden offers a plausible terrain for a renewed conceptualization due to the garden's potential, above all other instances, as the *locus* where nature and culture meet and become integrated, and the possibilities offered by extending the garden's metaphor to Planet Earth. Building on Scarso's argument, one may stress that a garden is not, however, a hybrid, since all its elements keep their own identities: following the sixteenth-century author Bartolomeu Taegio, a garden "is the third nature" (Hunt 2000, 32), the epitome of artificialized nature, following agriculture, taken to be the second nature, and *natura natura*, the wild and first nature.

The chapters included in Part III – "Staging the Anthropocene" – explore the intertwining of Anthropocene studies, gardens and various artistic practices. Far from providing mere illustrations or parallels, the arts, and in general the question of aesthetic representation, are particularly relevant to the issues that emerge in the Anthropocene debate, since these are often permeated by

phenomena which, for their complexity and their scale, are inherently "imperceptible". It is not fortuitous, therefore, that all four chapters in Part III are the result of a collaboration between two or more authors with different backgrounds or acting in more than one capacity: curator, environmental historian, artist, ecocriticist, STS scholar.

Chapter 9 – "A new machine in the garden? Staging technospheres in the Anthropocene" – by Nina Möllers and Luke Keogh, curators and historians of technology and of the environment, respectively, and historian of science and technology Helmuth Trischler, travels through several highlights of the exhibition *Welcome to the Anthropocene. The Earth in Our Hands*, held at Deutsches Museum (Munich) from December 2014 to September 2016. The authors, involved at different degrees in the conceptualization, design and management of the exhibition, show how the very act of staging the Anthropocene reveals profound parallels with gardening, since it is an activity that involves many different but interdependent processes whose results are not known beforehand. Recapitulating the most relevant concepts that structured the exhibition, this chapter singles out several key issues of the debate on the Anthropocene. Representing the complex question of the beginning of the Anthropocene, for instance, constituted a provocative challenge for a public exhibition. Far from mere technical matters, the different proposals stand on subtle and intricate connections between technological innovation and social transformation. Particular attention was given to portraying the emergence of a bio-geo-technosphere of interrelated processes as steps in an evolutionary process, the pace of which greatly increased during industrialization. An early twentieth-century Wardian case, for instance, offers a striking example of a turning point in the globalization of vegetal species, in which an apparently simple innovation actually altered the mobility networks on a global scale for centuries to come. Defining and representing "the age of humans", however, is not only a matter of what brought us here, of course, but also of what comes next, and this is where artistic experimentation is an inescapable source of insight. The exhibition included works by the Next Nature Network collective, a provocative display of disposable razor-blades as specimens of a "natural history" set-up, and the alluring "Anthropocenic Specimen Cabinet" of Yesenia Thibault-Picazo, a speculative exploration of the far future through a collection of imagined sediments. As another token of the puzzling convergence of human and geological time scales, *Welcome to the Anthropocene* also included a model of the "Clock of the Long Now", the ongoing project of designing and building a clock that may keep time for 10,000 years or more. The demanding technical and social implications of such an endeavour offer a precious and remarkable opportunity to discuss the unprecedented scale of the challenges we face. As the authors argue, fully acknowledging an inescapable quota of contingency and unruliness allows for an approach to the Anthropocene as a chance to decentre the Anthropos, rather than indulging in savagely optimistic technological utopias.

Chapter 10 – "The atom in the garden and the apocalyptic fungi: a tale on a global nuclearscape (with artworks and bird-songs)" – by science and technology

studies scholar Jaume Valentines-Álvarez and figurative artist Eric LoPresti possesses a distinct performative character, pushing the formal boundaries of academic literature to their limits. Calling for a multimodal experience, the chapter proposes an alluring interweaving of critical history scholarship on nuclear energy and anti-nuke movements with paintings of the *Lewisia rediviva* flowers that today bloom in the barren soils of the Nevada Atomic Test Site, a plant bringing survival and resistance through its very name. Moreover, each section of the text is accompanied by the suggestion of a corresponding musical score. Mushrooms, also particularly resilient to radioactivity, haunt the whole text and are evocated through many different angles, as image, metaphor, food, symbol and psychotropic substance. The authors juxtapose the "global techno-Eden" envisioned at the beginning of the atomic age with the nuclear Eden of "technocratic sustainability" proposed by the advocates of a Good Anthropocene. Conjuring up a vivid imagery that cuts across society, nature and technology, they contrast the giant deadly mushroom of nuclear detonation with the sparse underground networks of fungal mycelia, bringing to the fore the meshwork of many mutual aid-based social experiences that blossom in the harsh environments created by natural and human-induced catastrophe all over the globe.

In Chapter 11 – "Inhabitants: image politics in ongoing climate crisis", artists and cultural activists Mariana Silva and Pedro Neves Marques present the online video channel they founded in 2015 and which distributes through several online services short videos merging contemporary art with research journalism. In *A Brief History of Geoengineering*, for instance, in order to bring to the fore the interrelation of economic interests and marketing strategies that underpin a seemingly "technical" issue, several layers of alteration follow the speaker's argument and disturb a flow of patent applications images with background noises and CGI weather effects. The series on the struggles concerning oil extraction in Portugal, *For an Oil Free Future*, adopted a different approach, and, by mixing talking-head format with dystopian fiction, it aimed at both intervening in the debate and providing material for militant action. The current series *What is Deep Sea Mining?*, co-authored with art curator Margarida Mendes, introduce the audience to the emergent possibility of extracting valuable metals from certain mineral formations on the seabed. Explanations, case studies and interventions from experts and activists portray the many technical and environmental issues at stake. Furthermore, the fact that deep ocean habitats are still largely unexplored and that deep sea mining has yet to actually take place constitute a formidable challenge to image making. At the threshold that separates and joins research, experimentation and activism, the over 25 videos produced thus far not only constitute a bold intervention in several crucial environmental struggles, but also, and at the same time, a sophisticated experimental reflection on visibility, representation and the very nature of the video form in an "imagetic-ideological regime" dominated by market-driven virality.

In Chapter 12 – "Troubled gardens: nature–technoculture binary and the search for a Safe Operating Space in Hayao Miyazaki's *Mononoke Hime*" – by environmental engineer Ivo Louro and artist and essayist Ana Matilde Sousa,

both acting at the crossroads of environmental studies, cultural theory and artistic practice, explores the representation of gardens in the Anthropocene by analysing the animated movie *Princess Mononoke*, written and directed by Japanese author Hayao Miyazaki, co-founder of the celebrated Studio Ghibli. Louro and Sousa focus in particular on two specific locations of the film: the secret garden of Lady Eboshi in her Iron Town and the equally secluded pond of the elk-like Forest Spirit in the depths of the Cedar Forest. The two "gardens", as the authors convincingly argue, embody the essential conflict of opposite forces that structures the whole narrative: wilderness and civilization, human society and nature, growth and equilibrium. Moreover, the chapter shows how, in *Princess Mononoke*, gardens function as enclosed spaces of difference that, in their reciprocal connections, embody the inescapable interrelation of natural and human agencies. Unlike many contemporary representations of the conflict between nature and technological society, Myazaki's movie manages to avoid both a romantic nostalgia of lost harmony and eco-modernist optimism. Louro and Sousa show how in *Princess Mononoke* the intricate entanglements of nature, culture, gender and race all concur in portraying the acknowledgement of difference as essential to life itself. Based on this insight, the authors then offer a valuable qualification of the notion of "Safe Operating Space", stressing its inherently tense precariousness.

To sum up, all chapters in this volume encourage readers – from either an academic background or a larger audience – to engage in the debate on nature and human agency. Using specific case studies centred on the concept of garden, an "object" that we all know and experiment with, the authors propose to overcome simplistic dichotomies that identify nature with good and human actions with evil, and question the surreptitious a-historicism and determinism tone that often "colours" the debate and the discourses on the Anthropocene. The chapters in this volume use gardens and gardeners to analyse environmental issues as politicized phenomena driven by human agency and shaped both by individual and collective economic, political and cultural decisions. The garden is a negotiated space between humans and nature, and as all negotiations tell us, their outcome is not necessarily a win-win situation.

Notes

1 Not only is knowledge production indelibly tied to specific sites or venues, but there are also connections between more or less extended regions (provinces, countries) and the emergence of specific technoscientific cultures. Furthermore, the movements and circulation of technoscientific knowledge also put in evidence how encounters give rise to negotiations occurring in specific sites, accounting for instances of appropriation and transformation of knowledge, for the development of techniques of disciplining the senses, of securing the credibility and authority of travellers, scholars and mediators, and of reproducing and representing the unfamiliar and the novel.
2 See www.mpiwg-berlin.mpg.de/research/projects/DEPT1_Valleriani_Pratolino.
3 See www.anthropocene-curriculum.org/ for details.
4 Drexel University, the Society for the History of Technology, the Chemical Heritage Foundation, the Technische Universiteit Eindhoven, Virginia Tech, KTH Royal Institute of Technology.

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