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Towards Convivial Sciences

Uniting Strands of
Critical Inquiry

Critical Scientists Switzerland (Ed.)

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Andy Stirling

Preface

What roles can be played by scientists—and scientific institutions and cultures—in resisting the current horrors of the world and assisting, responsively and with humility, in struggles towards greater conviviality?

How can this question even be posed without compounding the structures of power, privilege, and patronage around science and technology that increasingly implicate these fields in some of the worst problems?

How to open not a self-undermining ‘balance’ but a creative new dimension for resolving tensions between the importance of respecting scientific understandings and imperatives to avoid authoritarianism?

Where key challenges are social, cultural, and political more than epistemic or technological, how can science contribute responsibly, without its own undue status in contemporary colonial modernity inadvertently warping into scientism?

How can science learn not just to be more trustworthy, but also to be more trusting of other cosmo-political actors—and of the different, wider, and more plural ways of knowing that it so often, even if unintentionally, eclipses?

How to move from assertions of science as a definitive body of knowledge supposedly in conflict with democratic struggle, to science as an always provisional and socially contingent process of emancipatory struggle in its own right?

With so many of its own institutional and cultural entrenchments, hierarchies, and regressive kinds of competitive individualism, how must science rework itself, to prefigure and help push wider progressive transformations?

If conviviality is about people and other Earthly beings finding ways to flourish together in difference, how can science become truly convivial: conceiving, nurturing, and enlivening dissenting research, transformative understandings, and liberatory knowledges?

How, most specifically, can science collectively murmur in its own multiplicity of ways from being an instrument of control, to a movement for care—helping shift political tides from fear to hope, authority to enquiry, facts to values, hubris to humility, calculation to deliberation, superiority to equality, individuals to collectives, competition to cooperation, singularity to diversity, growth to flourishing, and domination to solidarity?

In the sense with which this preface began, how can science rediscover its own vigour and political integrity as a progressive social movement rather than some supposedly neutral paternalistic authority: as the seventeenth-century motto of the Royal Society expresses it, *'nullius in verba'* — 'not on authority'!

Although this book of course offers no monolithic authority or categorical 'solutions' to these ends, I have not encountered a more insightful, thorough, provocative, and inspiring companion in this vital collective struggle. For this, I am hugely thankful.

Sussex

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1. Introduction

Science today is at a crossroads. It faces very high expectations of what it can and should deliver, but there is also a growing disillusionment with science, and sometimes outright rejection of it. Parts of society seem to have an almost religious faith in science and its ability to solve today's immense socio-ecological problems, whereas other parts have lost faith in science or have even become antisience. Although some scholars dismiss any problem within science itself, claiming that 'if there is a crisis, it is not a crisis of science or a crisis of research; it is a crisis of a shortage of research' (Callon, Lascoumes, and Barthe 2011, 258), others have come to a very different conclusion: that it is not the amount of research that is the problem but the way in which scientific knowledge is produced and handled in the public sphere. In this view, science suffers from contradictions between its public image and role, its approach to uncertainty and risk, and its relationship with democracy and the economy (Saltelli 2018). Yet others see the problem as rooted in the worldview of science and its relationship to power and domination (Harding 2008; Seth 2009; Liboiron 2021a).

Although many scientists and scientific institutions still tend to ignore the crisis of science, scholars with a broad range of perspectives have analysed its internal facets and intersections with society. They question not only the neoliberal influence on science and higher education institutions but also their precarious working conditions and ambiguous relationship to innovation, technology, and regulatory policies. Andrea Saltelli (2018, 88) has thus called for a fundamental shift:

a radically new concept, practice, and ethos need[s] to be imagined and acted, by scientists—who need to be clearer about what they can deliver and what they cannot—and by society, which must come to accept a more circumspect understanding of the role of science in informing societal and technological directions.¹

This book offers an analysis and synthesis—and ultimately calls for an alliance—of major strands of critique of the currently dominant approaches to conducting and perceiving science. It is both a provocation, because it challenges deeply held beliefs and values that are rarely questioned, and a wake-up call, because it asks the reader to take the critique seriously and to endorse initiatives to effect real change in the way science is constructed, funded, taught, and done.

At two workshops organized in 2019 and 2022 by an independent network named Critical Scientists Switzerland,² scientists from various disciplines and from across Europe and beyond discussed the role of science in society. Participants shared many concerns, including the takeover of science agendas and funding by corporations and philanthrocapitalists, and neoliberal modes of university governance.³ They were also worried about the increasing polarization, and sometimes weaponization, of science for political purposes. The participants agreed that the problem is often not scientific inquiry per se, but the particular worldview and schemes of knowledge production associated with the dominant strands of science. But they also recognized that a serious proposal for a different, more responsible science, more in tune with life processes, must be based on a thorough analysis of where dominant science has gone astray in its associations with power, its values, its knowledge production, and its institutions. This is how this book emerged. Before delving into analysis and synthesis, a few qualifications are in order: first, on the notion of dominant science; second, on the notion of science underlying dominant science; third, on the notion of critique; and fourth, on the scope of the book.

The term ‘dominant science’ refers to fields of science that, because of their supposedly instrumental role in maintaining modernist dreams of progress and solving today’s multifaceted crises, have received a large share of funding and been invested with high expectations. These fields range from medicine to biotechnology, from agronomy to chemistry, from engineering to climate science, and from machine learning to materials science. These are often considered the sound sciences, both in their track record and in their capability of proving things (Stengers 2018, 23). These fields of science have come to dominate both science’s impact on the world and

most people's perception of what 'science' is, should be, and can do. They are key to what Sandra Harding (2008, 3–4) has called the 'exceptionalist' and 'triumphalist' story usually told about the emergence of modern science and technology (see also Chakrabarti 2021). As she elaborates:

By exceptionalism I mean the belief that Western sciences alone among all human knowledge systems are capable of grasping reality in its own terms, ... that only modern Western sciences have demonstrated that they have the resources to escape the universal human tendency to project onto nature cultural assumptions, fears, and desires ... By triumphalism I mean the assumption that the history of science (which, for triumphalists, is thus the exceptionalist history of Western science) consists of a narrative of achievements. For triumphalists, this history has no significant downsides.

However, this book relies on the informed conviction that science without reflexivity is a dangerous undertaking; that we need other forms of inquiry that question and depart from the simplistic laudatory narrative about the merits of Western science and technology. Without denying the potential value of science and technology, we should acknowledge the significant environmental, cultural, and social damage they have also enabled. The book therefore focuses on the often neglected downsides of science, rather than on its achievements. This should in no way fuel antiscientific perspectives. On the contrary: it should lead to a call to reframe and reclaim science as a crucial form of collective reflexive inquiry. Although readers may be wary that we attribute too many problems to dominant science, we are concerned by the still-prevalent image of science as standing above and outside the interrelated crises we face today. One key insight is that the worldview of science in its dominant and totalizing form has devalued, suppressed, and sometimes even erased other forms of seeing and making sense of the world. We conclude that the scale of the issues with dominant science demands a transformation towards a different kind of science, which we call *convivial sciences*—in the plural.

An informed proposal for such convivial sciences first requires a thorough analysis of the full range of entanglements of dominant science with the current crises and their emergence—an analysis that this book systematically develops.

Dominant science relies on a particular notion of science. Yet science is a notoriously difficult term because it is imbued with a multiplicity of meanings. The English term science, for instance, has a narrower meaning than the German *Wissenschaft*, which also encompasses the social sciences and humanities. This book seeks to grapple with the narrower notion of Anglo-Saxon or Baconian science: the science of experimentation and laboratories, the science of distancing from the world. It is this modern and now-dominant form of science that has its roots in the Age of Revolutions,⁴ during the late eighteenth and early nineteenth centuries (see Cunningham and Williams 1993). Its premises and philosophical underpinnings often remain unstated.⁵ Typically, dominant science (Ziman 2000, 15) rests on three foundations. The first is a realist ontology: reality is out there and the same for everyone, and so there are objective facts about it that can be established. The second is an empiricist epistemology: objective facts about a phenomenon can be established through observation and measurement. And the third is an experimental methodology: explanations of phenomena are advanced by verifying or falsifying *a priori* hypotheses in experiments.

Contrary to the Eurocentric narrative of the ‘scientific revolution’ (e.g., Butterfield 1965), science is conceived in this book as a specifically modern Western invention, ‘a contingent, time-specific and culture-specific activity, as only one amongst the many ways of knowing which have existed, currently exist, or might exist’ (Cunningham and Williams 1993, 428). It has come to dominate in the world through European colonial and imperial attempts to suppress, discredit, and erase other forms of knowledge or epistemologies (see, e.g., Harding 1991; 2008; Merchant 1980; Federici 2012; Santos 2014; Chakrabarti 2021). Dominant forms of science are entangled with powerful discursive framings involving risk, technology, innovation, and progress, which tend to delete or hide alternative societal pathways while obscuring their own epistemic ambiguities and normative choices

(Millstone and van Zwanenberg 2000; Wynne 2002). However, this narrow notion of science has long been challenged by historians and philosophers of science, science and technology studies, and feminist, Indigenous, Black, and other nondominant epistemologies, which demand a radical transformation in the way we think about truth, objectivity, observation, empiricism, verification, and rationality. These perspectives challenge the conventional boundaries of the natural, physical, and social sciences, and demand a fundamental break with established thinking in the sociology and philosophy of science. Their perspectives are potentially transformative because they seek to dismantle or reconstruct the structures of power and knowledge that have informed and administered Western culture since the Enlightenment (Jansen 1990; Mol 2002; Blaser 2013; Ambroise and Broeck 2015; Yunkaporta 2019; Goss 2021; Liboiron, Higgins, and Tolbert 2024). To be sure, not all forms of Western natural science are dominant today either—sciences of the concrete, such as midwifery and preventive medicine, have been equally marginalized by the political-economic instrumentality of dominant science (Liboiron 2021c, 20–21).⁶

There are evidently diverging forms of critique and thus differing views about ‘what’s wrong with dominant science’. Many people, including many scientists, would argue that science is an inherently critical exercise, because it constantly questions its own insights and attempts to improve its theories of how things work or are constituted. Being critical in science by challenging and amending the state of knowledge is key, but it also tends to be limited in scope by staying within the frameworks of science (e.g., Shamoo and Resnik 2009; Andreoletti 2020; Longo 2018). Another, contrasting form of critique challenges the notion of a neutral and disinterested science by noting its own often implicit normative premises and entanglements with power and domination. This second form of critique has been advanced by scholars of science and technology, historians, sociologists, anthropologists of science, geographers, and decolonial and feminist scholars (e.g., Risman 2001; Krinsky 2006; Berlan 2023; Jessop 2018; Harding 1991; Grande 2015; Chakrabarti 2021). Yet, it tends to be too fundamental and too distanced from the scientific undertaking to matter to scientists. This has been long recognized by feminist scholars: for instance,

Hilary Rose (1983, 75) argued that feminists should refrain from a total rejection of science and instead pursue ‘the more positive goal of seeking to show how a feminist knowledge of the natural world offers an emancipatory rather than an exterminatory science’. More recently, in relation to the epistemological boundaries between physical and human geography, Marc Tadaki (2017) has proposed such a possible positive reappropriation of science as a third form of critique: being critical *through* science—emphasizing reflexive scientific practices and understanding critique as an integral part of doing science—alongside criticism *in* and *of* science.

This book synthesizes various strands of critique that challenge dominant science and help overcome its ontologically and epistemologically totalizing effects. We thus believe that all forms of critique are justified but remain incomplete and insufficient in isolation.⁷ As Max Liboiron (in Liboiron, Higgins, and Tolbert 2024, 344) has observed, ‘critique is necessary but insufficient—you need critique to be able to define the problem in order to try and address it, and, most importantly, how you define the problem forecloses on certain forms of addressing it versus others’. Criticism in science needs to be coupled with reflexivity to avoid it being co-opted by the dominant scientific view. Similarly, criticism of science remains incomplete and most likely ineffective without engaging with science. Tadaki’s proposal for being critical through science resonates with Liboiron’s, as both urge us to abandon thinking of critique simply as a methodological, epistemological, or ideological project and move towards thinking of critique as a crucial step in changing scientific practices. Making productive use of the various registers of critique, with their sometimes contradictory approaches, requires and enables a different democratic politics of science to reconcile rather than divide critical scientists. It requires what we call *convivial sciences*.

This book examines a diverse range of literature to provide an analysis that captures the array of problems associated with dominant science and, consequently, to synthesize the diverse forms of critiques in this book. Despite its broad scope, however, this analysis is necessarily incomplete, not least because of its still-Eurocentric vantage point and its heavy reliance on English-language texts. The analysis cannot cover everything; it inevitably

misses facets of important debates, and it cannot do full justice to the authors and issues it encompasses.⁸ A further disclaimer is essential: the irony of a Swiss-European collective of scientists calling for a transformation of science by including perspectives of Indigenous, Black, and other marginalized perspectives has not escaped us (see Arora and Stirling 2023). We write from a position of white, colonial, and Western epistemic but also very material privilege. And even for us as a collective of ‘critical’ scholars, leaving behind the tenets and structures of dominant science is a major challenge. The range of problems outlined here is therefore only intended to provide a backdrop against which possible ways forward towards convivial sciences can be collectively and agonistically elaborated. Such an effort should involve scholars, activists, and practitioners from neglected fields and geographical regions and collectives with their own visions of what science should look like to make meaningful transformation possible.

The book is structured as follows. Chapter 2 explores the implication of dominant science in the politics of appropriation of lives, worldviews, and lands both historically and in the present. This exploration includes decolonial, (eco-)feminist, and Indigenous critiques of the cosmology of control, the androcentric and Eurocentric origins of science, and the related imperial, colonial, and often violent appropriations of land and ways of being and knowing. Chapter 3 focuses on critiquing the key selling points of modern science, its ethos and, relatedly, its politics of values. These include science’s universalist claims, its supposedly privileged access to ‘truth’, and its utility in providing powerful technoscientific means of reshaping the world according to the needs of those in power. While not denying the value of scientific inquiry, this critique highlights the ways in which science has served the agendas of technoscientific instrumentalism, commercial exploitation, and Western hegemony. Chapter 4 considers the politics of knowledge: the various facets of scientific knowledge production among contested disciplinary hierarchies, discursive boundaries, scholasticism, and the often claimed primacy of scientific ways of knowing. This is complemented by analyses of the well-documented corporate influence on and sometimes capture of scientific knowledge production, including the problems of peer review and intermediation in scientific publishing

and dissemination. Chapter 5 deals with the politics of science organization, the organizational and institutional arrangements and practices in neoliberal times, and how they affect the who, what, and how of science. This includes analyses of both the epistemic injustices institutionalized in Westernized universities and the lack of diversity in the academy. The chapter also looks in some detail at how several decades of neoliberal reforms of public universities have impacted scientists, research, and research agendas. It highlights some of the troubling implications and consequences of the increasing commercial exploitation of research that has been catalysed by corporate funding, neoliberal agendas, and, more recently, the philanthrocapitalist influence on science. Chapter 6 examines the spectrum of critical practices among scientists. This includes scientific resistance and protest against political ignorance, advocacy for social or ecological causes, and whistleblowing and dissenting voices against powerful economic or political interests. It also includes scientists attempting to shift science's core values and its democratic politics. And it potentially means adopting a transdisciplinary perspective on humans and their socio-ecological relationships. In the final section, we argue that such a shift in perspective—along with the struggles for a more democratic and pluriversal science that plays a different role in society—can only gain traction through a transformation: from dominant science to convivial sciences.

2. Politics of Appropriation

Man's conquest of Nature, if the dreams of some scientific planners are realized, means the rule of a few hundreds of men over billions upon billions of men.

C. S. Lewis 2001, 58

As a dominant system, colonial relationships with land, life and knowledge have become mundane. Dominant systems stay dominant, in part because they dictate what counts as common sense: what seems normal and even natural.

Liboiron 2021a, 876

The Mansion of Science was constructed in tandem with capitalism, and we have always co-habited there. We raise our voices to protest against the injustices affecting the majority of the world's citizens and indeed all sentient life.

Boje 2001, para. 9

The agendas, funding, and institutions of science are strongly influenced by the socio-economic system in which they are embedded. This is key, as many of the authors on whom we base our analysis have shown, because it shapes the role that science and technology have had in the past, have in the present, and can have in the future. And from this wide angle, the laudatory narrative of Western progress and technological ingenuity has a dark and often unacknowledged underbelly: the history of dominant science and technology is closely linked to the oppressive histories of Western schemes and practices of modernity, colonialism, patriarchy, and capitalism along with their intersectional politics and cultural, material, and corporeal modes of appropriation. As we argue in this chapter, scientists and

the sciences have been shown to be complicit in, and even at the foundation of, the globalization of colonial modernity and its extractivist modes of capital accumulation through dispossession and destruction (2.1), the domination of women, nature, and non-Western others through scientific dualist cosmology (2.2 and 2.3), and the colonial erasure of histories and appropriation of other knowledges (2.4 and 2.5). We must therefore pay close attention to the implications of dominant science in these politics of appropriation, with all their silences, injustices, and forms of violence (2.6), to fully grasp the troubles with science and its institutions that we witness today. It is imperative that our position does not engender any form of antiscientific attitudes while maintaining a critical stance regarding the propagation of the term ‘antiscience’ (2.7).

2.1 Extreme Inequalities of Wealth and Power

As a great deal of work in the history of science makes abundantly clear, there is no separating imperial expansion and commercial motives on the one hand from the production of useful knowledge on the other.

Rieppel, Lean, and Deringer 2018, 12

As Francis Bacon well knew, knowledge of nature could also translate into new power. Scientific culture bred an intangible self-confidence, a willingness to put profit ahead of social pedigree, or a desire for universal reform in society and government.

M. C. Jacob and Stewart 2004, 157

The question of whose knowledge and whose science is a pivotal one and will be addressed in greater detail in the analysis of the influence of big money on dominant science in Chapter 5. But in a world where ‘money rules’ (often in rather opaque ways—see Bockelmann 2020; Pettifor 2017), one has to start with questions of wealth and power. As historians of science have noted, the history of capitalism and the history of modern science are intricately entangled (Gascoigne 1998; M. C. Jacob and Stewart 2004; Murphy 2012; Rieppel, Lean, and Deringer 2018). Although these

entanglements are complex and scientific research has not always benefited the rich, science has been instrumental both in shaping the horizons of accumulation and in providing the technoscientific means to extract value from people and ecosystems (Moore 2015). Scientific funding priorities have been more or less subtly skewed towards the interests of those in power (Crosland 1992; Noble 1977), and they have been used to justify and perpetuate social inequalities and to foster imaginaries of control (Jasanoff and Kim 2015; see also section 2.2). Thus, the politics of knowledge production, values, and scientific institutions cannot be properly understood without taking into account the extreme and growing inequalities of wealth and power both between the ‘rich’ and the ‘poor’ and between different parts of the world, namely the so-called Global South and the Global North (Hickel, Sullivan, and Zoomkawala 2021; Piketty 2014; 2020; Easlea 1980). Several tendencies are relevant to our purpose. First, historians and economists have witnessed a historically unprecedented concentration of wealth and corporate power in the hands of very few people in present times (see, e.g., Chancel et al. 2022; Glattfelder 2010; Piketty 2020).¹ These individuals benefit from the system as it works; they will not simply give away their wealth and enormous privileges, but will do everything to preserve them or secure their survival in times of troubles (Rushkoff 2022). Second, not only do the democratic foundations of Western nation-states appear weak (MacLean 2017; Mayer 2009; 2017; Mitchell 2011), but nation-states are increasingly dominated by anti-democratic economic institutions such as think tanks and national banks, corporations, and the super-rich (Bullough 2018; Vogl 2015; e.g., through investor-state dispute settlements [ISDS], see Tienhaara et al. 2022). Huge but often clandestine military- and security-industrial complexes also wield an enormous influence on scientific research priorities (as Oreskes 2021 has shown for oceanography) and innovation (see Harvey 2003a), public opinion² (Griffin and Cobb 2023), and political agendas, certainly in the US and EU (see, e.g., Hayes, Rowlands, and Buxton 2009; C. Jones 2017).

In addition to the military-industrial complex, the deep interconnections between corporations and states have led scholars to postulate that what still masquerades as a ‘nation-state’ is in fact a corporate state that

dances to the tune of big business and its oligarchic class (Kapferer 2005; Orrange 2020). Or, as Carlos Tornel observes in an interview with Alexander Dunlap, the role of the state in the Global South within global extractivism is that it ‘facilitates “political stability” to allow enclosure, commodification and extraction, meanwhile suppressing, imprisoning and killing opposition to its political and economic agendas’ (Dunlap and Tornel 2024, 166). Another strategy of capitalist elites has been to influence science and policymaking through their ‘philanthropic’ institutions (Kumbamu 2020; more on the influence of philanthrocapitalism on science in section 5.5). Third, multinational corporations have become enormously influential despite not being intended to serve the common good. Joel Bakan (2012; 2020) has even described them as sociopathic (and anti-democratic) institutions, designed to put short-term profit maximization before people and the planet, and legal scholars Steve Tombs and David Whyte (2015) have suggested that ‘criminality is part of the DNA of the modern corporation’ and thus called for their abolition (see also Whyte 2020).³ Multinational corporations have extended their influence into such social and political spheres as food, health, communications, education, and mobility with digital data. They have done so by extracting value from and by disrupting and surveilling ever more social and socio-ecological relations with the help of digital data generated by ‘users’ of their technologies (Zuboff 2018). The whole ‘digital revolution’ appears to be a natural force, but on further inspection it more closely resembles a marketing coup by big tech companies trying to shape our collective future to their liking (for an analysis in the food sector, see the report from ETC Group 2022 on global ‘food barons’), while whitewashing or greenwashing their activities with the help of PR firms (Jansen 2016; MacManus 2016; Pearce and Tombs 2019). Intense and often successful lobbying by corporations and corporate interest groups for their products and profit models (see section 4.7) and revolving doors between politics and business (Lüchinger and Moser 2023; Pons-Hernández 2022)⁴ too often make democratic institutions seem like a caricature of what they are supposed to be: the government of the people for some kind of commonly defined and negotiated good (see also Kus 2016).

These three facets of extreme inequalities of power and money—unprecedented concentration of wealth, political dominance of the economically and militarily powerful, and increasing military, corporate, and philanthropic control over scientific policy—are important contextual features of what we discuss in Chapter 5: the politics of scientific institutions and academic governance and the increasing pressures in this area.

2.2 Cosmology of Control: Materialism and Human–Nature Dualism

Much of modern culture is based upon the presupposition that nature and society are thoroughly separate entities; but, in practice, they ... [are] so entangled that the distinction amount[s] to little of consequence.

Mirowski 2017, 437

Reason has been made a vehicle for domination and death; it can and must become a vehicle for liberation and life.

Plumwood 2002, 5

Scientific knowledge means technological power over nature.

Francis Bacon, The New Atlantis, 1626

The domination of other ways of living and knowing stems from a cosmology that constitutes the worldview of modernity. Sandy Grande (2015, 99), an eminent Native American and Indigenous Studies scholar, argues that this cosmology contains ‘the deep structures of colonialist consciousness’ and identifies five foundational beliefs that are rarely acknowledged as such, amongst them the ‘belief in the essential quality of the universe and of “reality” as impersonal, secular, material, mechanistic, and relativistic’ and the ‘belief in human beings as separate from and superior to the rest of nature.’⁵ Modern science is deeply rooted in a materialist cosmology and the belief that ‘the real world is composed exclusively of material things’ (Bunge 1981, ix). This materialism has serious consequences: if the world consists only of matter (Bunge 1981, 3–5),⁶ natural science ultimately has

the role of arbiter of *how* it comes to matter, even when it comes to questions mind and consciousness (e.g., Damasio 2012). Although this materialist cosmology still holds great sway and forms the basis of the dominant natural and technological sciences and positivist methodologies, scientists from a wide range of disciplines consider it too narrow and call for its expansion (see, e.g., VanPool and VanPool 2023; Woollacott, Shumway-Cook, and Renesch 2023; <https://www.opensciences.org/>).⁷

Dominant science relies on not only a materialist cosmology, but also a profoundly dualist one. Dualist cosmology or ontology

assumes that we live in a twofold world which is constituted, first, by material objects and their real interactions that exist independent of human perception; and, second, the universe of subjective ideas, concepts, thoughts, and feelings that are only believed to exist in the consciousness of human beings. (Rist, Bottazzi, and Jacobi 2023, 13–14)

Such a dualist ontology views

humans and nature as being separated, into a subjective social world and an objective natural world. Here, the relation between humans and nature is embedded in an anthropocentric worldview, in which nature is seen as instrumental for the creation of wealth and security. (Rist, Bottazzi, and Jacobi 2023, 14)

Human–nature dualism must be understood as ‘a system of ideas that takes a radically separated reason to be the essential characteristic of humans and situates human life outside and above an inferiorized and manipulable nature’ (Plumwood 2002, 4). It is closely related to other polarizing dualisms at the heart of dominant science and Western culture, such as rational–emotional, objective–subjective, and universal–local. Ecofeminists such as Val Plumwood and Carolyn Merchant have observed that women and non-Whites (as well as animals)⁸ are ascribed to the subordinate poles of these dualisms in order to justify their subjugation and exploitation by systems of patriarchy, colonialism, and extractive capitalism. Conse-

quently, as Plumwood (2002, 4) notes, ‘the ecological crisis requires from us a new kind of culture because a major factor in its development has been the rationalist culture and the associated human–nature dualism characteristic of the West.’ She cautions against confusing rationalism with reason, because rationalism is a historically evolved but now dominant ‘doctrine about reason, its place at the apex of human life, and the practice of oppositional construction in relation to its “others”, especially the body and nature, which are simultaneously relied upon but disavowed or taken for granted’ (Plumwood 2002, 18).⁹ Elsewhere, she states that

it is not reason itself that is the problem, ... but rather arrogant and insensitive forms of it that have evolved in the framework of rationalism and its dominant narrative of reason’s mastery of the opposing sphere of nature and disengagement from nature’s contaminating elements of emotion, attachment, and embodiment. (Plumwood 2002, 5)

However, whereas ‘science is usually seen as the appropriate place to locate ecological concern and discussion’ (Plumwood 2002, 10), if the rationality that underpins today’s globalized Western culture is the primary problem, we need a new ‘ecology of reason’ that sees human beings as ecological and embodied beings—with profound consequences not only for science, but also for our political and economic relations. This is also the reason why the current technoscientific and rational economic approaches to overcoming the socio-ecological crisis are doomed to fail. As Plumwood puts it,

technofix solutions make no attempt to rethink human culture, dominant lifestyles and demands on nature, indeed they tend to assume that these are unchangeable. They aim rather to meet these demands more efficiently through smarter technology, deliberately bracketing political and cultural reflection and admissions of failure. But we did not just stumble by some freak technological accident into the ecological mess we have made, and it will take more than a few bright boys and better toys to get us out of it. Our current debacle is the fruit

of a human- and reason-centred culture that is at least a couple of millennia old, whose contrived blindness to ecological relationships is the fundamental condition underlying our destructive and insensitive technology and behaviour. To counter these factors, we need a deep and comprehensive restructuring of culture that rethinks and reworks human locations and relations to nature all the way down. Reason can certainly play a role in this rethinking, but it must be a fully self-critical form of reason that does not flinch from examining its own role in the crisis. (Plumwood 2002, 8)

It is important to acknowledge that the worldview of materialist reduction of the world paired with the dualist categories imposed on it have both rendered technoscientific approaches so dominant and devastating. It requires us to consider how the scientific-cum-colonial ‘fictions, fantasies and fallacies of control are entangled with upscaled processes of toxic extraction in modern worlds’ (Arora and Stirling 2023, 10), and the consequences for the past and present lifeworlds of people affected by such a worldview:

These processes are materialized through the deployment of technologies like hydroelectric dams, industrial agricultures, open-pit mining and tailing dams. They constitute some of the most acute devastations wrought by modernization of Indigenous people’s sociomaterial worlds of living and knowing. (Arora and Stirling 2023, 10)

The large-scale ecological devastation wrought by such modernist interventions speaks of a doubly toxic relationship of humans to the Earth.

Overall, we need to recognize that the primary promise of modernity is to control nature as well as women and non-White peoples associated with nature (see Merchant 1991), which is only possible if nature is understood as something separate from human beings and devoid of any intrinsic value (see also Aldeia and Alves 2019). Seemingly benign concepts such

as wilderness and nature conservation are also deeply embedded in this promise, as Plumwood (1993, 163) has observed:

The use of hyperseparated concepts of human and nature which rule out the ground of interaction and demand that true nature exclude all human influence makes the concept of wilderness extremely problematic in relation to Indigenous peoples who both sustain and are sustained by their land and its ecosystems.

The concept of wilderness is thus an example of how the Western human–nature dichotomy precludes a more relational understanding of ecologies, with positive human interactions and a caring attitude (see also Tronto 1995). Ultimately, the extractive logic of capitalism is closely linked to this Western cosmology, which makes it possible to ignore the interconnectedness of all life and to impose an abstract and fatally careless rationalist economic approach on the land and living beings (see Box 1).

Box 1. Sculpting Evolution

Gene drives are a genetic technology that is claimed to be able to bypass the rules of inheritance and permanently alter or even eradicate entire wild populations or species. Ideas for using gene drives range from eradicating vector-borne diseases such as malaria, dengue, and Zika to protecting endangered species from harmful invasive alien species such as rodents on islands, to controlling agricultural pests. Kevin Esvelt, director of the Sculpting Evolution Group at the MIT Media Lab and inventor of CRISPR/Cas gene drives, sees the technology

as a way to rectify what he considers a larger failing of the universe, which is that evolution itself ‘has no moral compass’. It’s just a blind process whose only rule is to survive. Gene drives, by giving humankind the ability to fine-tune the battle for survival, could make the world a more just place. (Regalado 2016, para. 16)

Many cosmologies other than Esvelt's materialism see a particular wisdom in nature and evolution and hence attempt to tune in to this wisdom and cooperate with it. In contrast, the 'moral compass' of which Esvelt speaks seems to revolve solely around the interest of humankind. Nature and the living world are instrumentalized to serve humans, and the value of life and living beings themselves and the interrelatedness between humans, nature, and the living world does not seem to be acknowledged. On the contrary, certain species, such as disease-carrying mosquitoes, are seen as 'bad' and targeted for extermination.¹⁰ Their contribution to the ecosystem is not valued as such. However, mosquitoes perform a wide range of functions in the ecosystem.¹¹ Finally, we cannot predict which species will occupy the vacated ecological niche, whether it will be another disease vector, or what the ecological consequences will be (Lebrecht, Wallace, and Castro 2019). The worldview behind gene drives has been criticized as patriarchal, reductionist, technocratic, and nonrelational, because nature is seen as a machine that can be fixed by technological means, and because mechanistic engineering principles are applied to biology (Preston and Wickson 2019, 234–35).

The human obsession with controlling nature and transforming the world has left an unprecedented mark on both the world's ecosystems and the climate: wildlife is facing extinction rates that have led scientists to declare this the Earth's sixth mass extinction event (Kolbert 2014); land and soil degradation, water and air pollution, and climate disruption are widely recognized impacts of human activity (S. L. Lewis and Maslin 2015). This has led earth system scientists, notably Paul Crutzen (2006), to suggest that we are living in a new geological epoch, the Anthropocene, or Age of Man. However, as Jason Moore (2016) and other social scientists have noted, the notion of the Anthropocene inadvertently implies that all humans have contributed equally to the destruction in the biosphere on a scale that leaves geological traces. But it is only a small minority of people who have imposed the extractivist regime on other peoples around the world; these others have seen their livelihoods, communities, and even lives

destroyed. Therefore, scholars have proposed that the new era be called the Capitalocene, Plantationocene or Chthulucene¹² to account for this, each with a different emphasis (Davis et al. 2019; Haraway 2015). Without delving into the details of the debate here, we wish to highlight that it clearly demonstrates the importance of defining the problem and knowledge and truth claims implicit in it for how we can imagine addressing the current socio-ecological crisis. Or as Davis et al. (2019, 4) note: ‘Such epistemological blinders in Anthropocene scholarship to the role of racism and resistance are not simply academic oversights: They have implications for how we might envision (or fail to envision) just responses to global ecological change’.

The problem with these alternative denominators is that they suffer from an equally ‘singularising, categorical, planet-spanning, uncertainty-sidelining, quasi-geological’ (Stirling 2025, 2) framing of the problem by using the same *-cene* suffix. As Andy Stirling (2025, 3) puts it, ‘any intervention (even critical or ironic) framed in terms alluding to any notionally singular prospective world-spanning geological epoch, is likely to be more part of the problem than the solution’. Consequently, he suggests that ‘what is arguably needed for transformations to be achieved away from the human and ecological destructions of colonial modernity, is a politics that directly side-steps, substitutes, or disrupts (rather than reinforces) these pervasive fixations, fallacies, and fantasies of control’ (Stirling 2025, 3). As a result, the maxim of ‘system change, not climate change’ advocated by climate strikers requires a fundamental shift in cultural values and the abolition of the foundational imaginary of control and dualisms at the core of the dominant, modernist worldview. For an example of such a shift, see the rights of nature (RoN) enshrined in Ecuador’s constitution in 2008 (Tănăsescu et al. 2024; and the Universal Declaration of Rights of Mother Earth 2010).