STUDIES IN
THE CIRCUMPOLAR NORTH

# Arctic Abstractive Industry

## ASSEMBLING THE VALUABLE AND VULNERABLE NORTH

Arthur Mason

# ARCTIC ABSTRACTIVE INDUSTRY

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## *Assembling the Valuable and Vulnerable North*

**Edited by**

**Arthur Mason**

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# Preface

## *From Northern Lights to Fluorescent Lights*

During the 1990s I became involved in archaeology and cultural interpretation on Kodiak Island, Alaska, at a time when communal heritage work was aimed at deepening cultural pride in Alaska Native self-awareness and identity. It was also a period of controversy over federal land transfers to local Native corporations in obeyance of the rules established under the Alaska Native Claims Settlement Act of 1971 (ANCSA). The agenda-setting process of the US Congress, which moves along decadal time scales, had prompted a need for alternative strategies for provoking outcomes to meet the changing urgencies and growing demands in rural Alaska. At the time, I possessed only a vague sense of the unfinished colonial entanglements of Indigenous communities and anthropologists, whose possibilities and limitations of collaboration are continuously unfolding.

For example, featured articles about community efforts to repatriate Kodiak's archaeological treasures from national museums and universities began appearing in national media outlets including the *New York Times*. Also, a National Geographic film aired nationwide on public television dramatizing the eighteenth-century Russian conquest of Kodiak. The documentary film provided moving testimony from locals and academics alike and was framed for American audiences by drawing a direct parallel to the violent encounters typical of settler-colonialism in the "Lower 48" or contiguous United States.

As I came to realize, those within my extended professional orbit with media skills and political expertise often orchestrated these performances directly engaging the wider public with the aim of influ-

encing the federal policy process. The growing sense of revival and renewal addressed also the larger forces of structural asymmetry that had resulted in various excessive historical processes, including colonial violence, expropriation, labor mobility, settler-colonialism, and industrial disaster. Such was the case in the wake of the 1989 *Exxon Valdez* oil spill, when a six-member federal-state trustee council imposed various forms of scientific authority to determine how to distribute the one billion dollars recovered from the Exxon oil corporation to restore coastal communities, including Kodiak Island, affected by the devastation.

Most of what I describe above took place beyond my own level of comprehension at the time. Yes. I was there. Participating—but not seeing the ins and outs of the situation. It was as if what I required was *an epiphany* so that my self-knowledge would coincide with a recognition of my lack of knowledge of others. The political philosopher Alasdair MacIntyre has framed situations like this aptly by explaining "in these moments of epiphany we recognize simultaneously the nature of the strategic and tactical tasks in which we are involved and the opacity of the conduct of those others with whom we are implicated" (1973: 326). Serendipitously, one such occurrence took place when the US senator Ted Stevens walked into the cultural center where I worked, without giving much advance notice of a visit, to speak informally with local elders about his legislative priorities.

I can remember well the sense of wonderment I felt from my proximity to the senator and his aide, who was roughly my age. The politicos appeared from the distant world of Washington, DC as if out of thin air. With their hands clasped in a relaxed manner, the two men stood erect wearing matching blue blazers along with the twinkliest shoeshines that ever had crossed the cultural center's threshold. With a population of six thousand, Kodiak is one of the largest fishing ports in the United States in terms of commercial landings. The cultural center did not reflect any of the opulence associated with the fishing industry. Instead, it was housed in an unfurnished warehouse that was located on a wind-swept gravel road heading out of town. With the arrival of the senator and his aide the space no longer appeared to me as a repository of cultural knowledge but instead had taken on the feel of a backstage rehearsal, moments before the start of a theatrical production. Looking back, the meeting was a type of happening whose realization I had only been exposed to from reading books—for example, Max Weber's description of politics as a vocation and especially its associated feelings of vanity with having one's fingers on the pulse of an historically important event.

Afterward, I accompanied senator Steven's aide, Paul Transfell, to dinner and listened in bewilderment to his version of actual existing events affecting Alaskans. According to him, our fate was in the hands of persons like the US Secretary of the Interior who needed to rescind prohibitions against wilderness reviews by the Bureau of Land Management and to reconsider navigability claims under the Submerged Lands Act. Further, there were members of Congress who needed to clarify the authority of Tribes in Alaska with Tribal powers in the Lower 48 and to complete federal land transfers to the State and to Native corporations under the Statehood Act and ANCSA. Transfell also referred to a packet of energy legislation that needed Congressional passage. These included but were not limited to oil development in "ANWR," oil and gas leasing in the "NPR-A," lease sales to develop the "OCS," and the proposed exploitation of other federally protected hydrocarbon frontiers whose acronyms I had trouble scribbling down fast enough.

Returning to my epiphany, it was upon hearing of Transfell's political life firsthand that I became both fascinated and alarmed by the possibility that my own status as a classical ethnographer reflected a species of bare life. While dining with Transfell, I became aware that my Alaskan experience amounted to an incidental feature located thousands of miles from the pedestal of Washington, DC's demiurgic status. Demiurge is a concept from the Platonic school and refers to an artisan-like figure responsible for the fashioning and maintenance of the physical universe. Here, I use the term to cast light on the power of federal policy as an obligatory passage point for local capacities.

Some years later in Washington, DC, I worked alongside Transfell on activities related to federal energy legislation for an Alaska natural gas pipeline. Through a successive chain of different vantage points that included serving as aide in the Alaska state legislature and later in the Office of the Alaska Governor, I had moved away from my own sense of the local and into other people's sense of the political—a transformation that may be considered a process of abstraction where *being-in-the-state-of-Alaska* became *being-for-the-state-of-Alaska*. While the former involves the status of being situated in a physical location, the latter is a more abstract status that is conjured during moments of political signification.

As an example, during teleconference exchanges between major oil companies and the State of Alaska that were dominated by lawyers, negotiations would immediately halt when for any reason the company or state representative was inaudibly distant to discussion. When counsel for BP or Phillips became aware that their client stepped

away for any amount of time, counsel would announce "I can't speak until my client is present," or "my client is not on the phone and until he gets on the phone, I can't address the issue." In like manner, my counsel, that is, lawyers for the State of Alaska, were forbidden to discuss legislation until I was audibly present—regardless of whether I understood the arcane details of legislation under discussion. In effect, I had become a fleshly effigy for the state's political fortunes, that is, a docile stand-in, for a brief time, burnished under the fluorescent lights of the real and effective.

The inspiration for the chapters in this volume is an attempt to assemble disparate vantage points such as those above that illuminate how processes of abstraction and their effects come to have power bearing on the Northern locations and land/seascapes through which they are generated. In the above description, my energy lobbyist experience *for Alaska* invokes a reality detached from my community experience *in Alaska* and that lies in relation and even opposition to the part from which it was abstracted.

This volume is an attempt to examine such processes at work in variously articulated sites of industrial extraction and ecological vulnerability in the Arctic through methodologically diverse engagements with the concept of abstraction. Their inclusion is a result in part of the continued excitement for the work of colleagues whose research on Arctic late industrialism, resource extraction, and environmental change I have followed over the past two decades. The authors in this collection are also friends with whom I have shared exceptional exchanges at Arctic science meetings, extractive industry workshops, and visiting academic positions sponsored through circumpolar science funding. During the 2007/09 International Polar Year, for example, Karen Hébert and I became acquainted as early career professionals while attending the New Generation Polar Research (NGPR) Symposium in Colorado Springs. Funded by the US National Science Foundation the NGPR gathered nearly fifty polar scientists to catalyze the formation of an interdisciplinary community while working collectively across the natural and social sciences. The gathering took place over eight days at the La Foret Retreat Center, a rustic camp surrounded by several hundred acres of pine forest oasis. In attendance were Arctic science luminaries including Lonnie Thompson whose paleoclimatological research appears prominently in former Vice President Al Gore's dramatic presentation of $CO_2$ increase in the film *An Inconvenient Truth*. A fair amount of time was devoted to presentations of the state of the Arctic science topics, relating to perma-

frost, coastal erosion, ice core data, and sea ice measurements. Karen and I were among the few social scientists. Indigenous presence was even less visible. From my own recollection, much of what we discussed was often limited to that which could be observed within the dominant paradigm of an empirically demonstrated or quantified science. Authors to this volume, by contrast, take a somewhat different (by which I mean exploratory) approach to studying the changing Arctic by reflecting on how vulnerability and representation rely upon various forms and acts of recognition.

Importantly, several authors in this volume share a concern with the politics of energy management during the millennial conditions of Arctic hydrocarbon development. The ethnography of Carly Dokis on natural gas development in Canada's Mackenzie Valley, for example, overlapped with my own study into prospects at the adjacent hydrocarbon region of Alaska's North Slope during the 2000s. Throughout the 1990s, natural gas became the fuel of choice in the newly integrated US and Canadian energy market. With the California energy crisis of 2001, natural gas prices skyrocketed nine-fold resulting in the recall of California Governor Gary Davis and price gouging by the Enron Corporation, America's largest gas trading company before its bankruptcy in December 2001. Experts announced that conventional midcontinental gas supplies were entering into a phase of steep decline. Faced with the choice of relying on sources in the form of liquefied natural gas shipped from countries such as Algeria or Nigeria where supply disruptions were forecasted, politicians eager for new revenue streams in Alaska and Canada's Northwest Territories united with midcontinental governors who expressed concern over reliability of supply and together put construction of North American Arctic pipelines on top of their legislative agendas while announcing multimillion dollar campaigns to spur pipeline construction.

From 2000–07, Carly and I in our own respective ways became witness to this "period of fever" from which leaders in finance promoted new legal arrangements in a struggle to overturn the Arctic power politics of energy infrastructure decision-making (Dokis 2016; Mason 2019). In this manner, the agenda pursued in this volume builds upon my earlier effort as part of the edited volume titled *Subterranean Estates: Life Worlds of Oil and Gas* assembled by Hannah Appel, Michael Watts, and myself (2015). In that volume, we argue that forms of political, economic, and social relations are engineered out of flows of energy; that energy helps organize politics; and that the oil and gas world manufactures a vast archive of knowledge produced and fought

over by multiple actors. Thus, our critical topography of the oil and gas industry speaks to complex intersections across a multiplicity of disciplines of what is arguably one of the most global and technologically complex of industries.

Crucially, in that volume we take up the concept of *oil as metonym* which refers to the inadequate explanations contained in one-sided abstractions often relied upon by the oil and gas industry—that is, partial, part-for-the-whole, types of explanation based on detaching a single element (the market, for example) to be used as a lens for much broader understandings and decision-making—and thus, that provide misleading or all-or-nothing distinctions between economics and politics, science and ideology, corruption and rationality. In this way, aspects of representational practices, developmental pathologies, and consumer worlds, conceptualized as metonym in the 2015 edited volume, are revisited in this one through the notion of abstraction, which foregrounds the opening up of invisibilities that, for example, periods of upheaval like the millennial energy crisis reveal. In this volume, our focus on the Arctic takes up a different set of abstractive forms—which I identify as Decay, Imagery, and Inflection—with hopefully a more fine-grained attention to the Anthropocene's emerging politics of difference, aesthetic concealments of production, and external discourses that replace critical judgment on dispossession and exploitation.

Arthur Mason
Trondheim, March 2021

## References

Appel, Hannah, Arthur Mason, and Michael Watts, eds. 2015. *Subterranean Estates: Life Worlds of Oil and Gas*. Ithaca: Cornell University Press.

Dokis, Carly. 2016. *Where the Rivers Meet: Pipelines, Participatory Resource Management, and Aboriginal-State Relations in the Northwest Territories*. Vancouver: UBC Press.

MacIntyre, Alasdair. 1973. "Ideology, Social Science, and Revolution." *Comparative Politics* 5(3): 321–42.

Mason, Arthur. 2019. "Consulting Virtue: From Judgment to Decision Making in the Natural Gas Industry." *Journal of the Royal Anthropological Institute* 25(S1): 124–39.

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INTRODUCTION

# Arctic Late Industrialism

## Extracting Value through Abstraction

Arthur Mason

During a recent visit to the Lofoten Islands of Arctic Norway, some colleagues and I visited a seaweed harvesting company committed to protecting the marine environment through their use of sustainable methods. What struck me was how dependent our conversation quickly became on the use of a computer screen. The employees utilized digital mapping tools where data about seaweed collection was rendered into seductively crisp images. Over the next several days, our traveling seminar continued to exchange (inter)disciplinary knowledge, mediated as often as not by the support of a well-crafted slide deck. I could not help but think that telling stories in the circumpolar North increasingly relies on ready-made digital platforms.

Looking back to another phase of my life in the Arctic, working among the Alutiiq/Sugpiaq of southwestern Alaska during the 1990s, I recalled a version of heritage work wherein the dimensions and values of Indigenous traditions were still mediated through nondigital materials: physical objects, scaffolded by forms of knowing that reached back before the written record. Yet the community-based spaces where this work took place did not fetishize the local or the analog. Rather, they were sites for the creation of a sense of Alaska Native self-awareness and identity explicitly defined in relation to outside experts along new axes of common purpose.

This passage from an unbroken chain of firsthand knowledge accumulation to a moment in which the Arctic is being reimagined as digi-

tal, sensible, and smooth marks a discontinuity, whose characteristics bear a resemblance to the transitional period that Kim Fortun (2012) has called "late industrialism." For Fortun, late industrialism speaks to a degraded state of industrial infrastructure and exhausted explanatory paradigms, overlaid by internet freedoms of exchange. It also reflects the scientific framing of planetary environmental problems such as global warming (Edwards 2010; Masco 2010). Fortun traces the beginning of late industrialism to the 1984 chemical disaster in Bhopal, India, when a Union Carbide chemical plant blew up, killing thousands and injuring many more.

In a kind of ecological homology to the Bhopal scale of human loss, the 1989 *Exxon Valdez* oil spill in Alaska might be said to mark the beginning of *Arctic late industrialism*. A disaster of enormous magnitude, the spill resulting from an oil tanker that ran aground put nearly eleven million gallons of crude oil into Alaska's Prince William Sound. *Exxon Valdez* redefined relations between communities and experts (see Mason 2008) and helped to constitute the Arctic as a source of value ultimately measurable in the face of its own annihilation.

Borrowing Fortun's periodizing terminology as a critical orientation, Arctic late industrialism names lingering aspirations to connect up with the aging infrastructure of lower latitudes and confrontations with the adverse impacts of climate change for land and marine ecosystems, as well as local ways of life. In this unfinished meantime, atrophied plans and path dependencies keep rolling ten years into the future even as sovereignty becomes further decentralized through emerging forms of digital extrastatecraft (Easterling 2016).

This volume examines the processes at work in variously articulated sites of industrial extraction and ecological vulnerability in the contemporary Arctic, while refusing idealized displacements that conceal relations of exploitation, on the one hand, and productions and appropriations of value, on the other. Its contributors do so through methodologically diverse engagements with the concept of abstraction, which gained salience in the mid-twentieth century at the very moment when debates over a transition to postindustrialism led theorists toward new forms of conceptualization (Brick 1992). To apprehend Arctic resource regimes as *abstractive* is at once to evoke and depart from the more familiar *extractive*, and this slippage between prefixes registers various kinds of movements from the material to the immaterial or symbolic and back again.

The chapters in this collection consider the role of indicators, which decontextualize and depoliticize as they quantify, as well as aesthetic forms, which persuade, seduce, and conjure in a different register.

Both, in what follows, are revealed to entail abstractive forms of expertise employed in the service of an effort to make everything under the sun exchangeable as money. In some cases, rationalist confidence in indicators to generate their own criteria and forms of validation is matched by a correspondence to the real. But just as frequently, this confidence is misplaced, producing excesses and gaps that are diagnostic of the unruliness of the material world and its inhabitants. Hence, the volume is concerned with both the accomplishments of abstraction and the many ways it can fail.

Abstractive forms point to processes that unfold beyond the scale of the local, to the point that understanding changes like global warming involves perceiving that "locality is an abstraction" (Morton 2013: 47). But these phenomenal forms still owe their origins to somewhere. As Mary Douglas (1966: 60) writes of deteriorated orders, their "half-identity still clings to them and the clarity of the scene in which they obtrude is impaired by their presence." Such ambiguity produces uneven perceptions, which ramify to produce the Arctic as a kind of diagrammatic representation of one quality of our planet at large: namely, its vulnerability (Helmreich 2011).

Readers familiar with late-twentieth-century debates about the social effectivity of things (Appadurai 1986; Thomas 1991) will recall similar movements between the abstract and the concrete, as mutable notions of identity were said to mirror capitalism's power over individuals through the production of an economy of signs experienced through objects of "specular reflection" (Baudrillard 1981: 37). More recently, the structure of the oil industry has been described in terms of its abstractive tendencies toward modularity, scaling, carbonscaping, technological zoning, and indeterminacy (Barry 2006; Bridge 2009; T. Mitchell 2012; Haarstad and Wanvik 2017; Weszklanys 2015). Michael Watts (2012: 440) describes "deep infrastructures [of] pipelines, rigs, flowstations, tankers, financiers, engineering firms, [and] security forces" that form an oil assemblage that suspends its social actors between life and death.

While the abstractions of oil and other commodities continue to be examined through the frame of petroculture (Wilson, Szeman, and Carlson 2017; Kinder and Stepanik 2020), less attention has been paid to the forms of value created by their concretization as climate change (but see Tsing et al. 2017). In this introduction, I suggest that transformations in theories of value beyond the dichotomy of classical political economy and Marxism form the preconditions for this analytical movement. In the chapters that follow, Arctic late industrial themes such as vulnerability, financialization, and the loss of life prompt con-

tributors to reflect on the depletion of the Earth and the possibilities for rebuilding value through various modes of aesthetics and ethics (see also Davis and Turpin 2015).

Throughout, the concept of abstraction that we employ cannot be reduced to constructions in the mind. Our usage is closer to that of Slavoj Žižek (1989), who has explored abstraction as a strange sort of inversion that takes place in the value of commodities. In the context of market exchange, value assumes the guise of a natural property of another entity, money. But he argues value is properly understood as an insignia of a network of social relations between the agents of production. Thus, for Žižek (1989: 24), abstraction is misrecognition: "What is really a structural effect, an effect of the network of relations between elements, appears as an immediate property of one of the elements, as if this property also belongs to it outside its relation with other elements."

In this volume, abstraction refers to the value of the substance of a thing (whether living or nonliving) by reference to the conditions of its becoming and to further inversions of value that lead toward its becoming something else. To abstract is to detach a part of reality from the rest of it. The part that is abstracted is put into relation with and often opposition to the whole, thus leading to an inversion of its ascribed value. The critical theorist Alberto Toscano (2015: 70), whose work on abstraction is an important source of inspiration for this volume, notes that this process constitutes an "additive practice" that entails both arbitrary and focused selection. Hence, moving beyond Žižek, abstraction is at once a creative act of recognition and a construction of a new reality.

The study of abstraction can thus help us attune to the formal operations that make "impossible equations possible" (Rancière 2015: 107), whereby representation, expression, and adoptions of form disclose the politics of production (and of representation itself). Indeed, Toscano (2008: 58) has called for the cultivation of "warm abstractions" that could serve as more supple, figurative counterparts to the mechanisms of political economy. In an era that will be defined by melt and glare, it is not unreasonable to suggest that all abstractions are becoming warm abstractions, with far-reaching consequences for both theory and praxis.

In the remainder of this introduction, I draw on existing scholarship and on my own research to suggest some possible stakes and consequences of approaching Arctic late industrialism through the prism of abstractive industry. I then offer an overview of the interventions that the individual chapters make, as well as those that the

volume as a whole seeks to make in the domain of Arctic research and in social studies of energy and climate more broadly.

## Assembling the Valuable and Vulnerable

Despite the profound power of abstractions—what Stuart Hall (1992) describes as their formulating practices that enable divisions such as "The West and the Rest"—Michel Foucault (1971) considered abstractions as fragile, noting that discursive abstractions give rise to anxiety. Their appearance suggests an ambiguity that likely gives reason to institutional authority in support of their legitimacy.

Foucault identifies multiple forms of uncertainty that define the materiality of such anxiety: first, uncertainty arising from suspicion of the conflicts and injuries that lie behind the work of abstraction, even long after use has "chipped away" the rough edges; second, as mentioned, by the performativity of abstractions as written or spoken objects; third, uncertainty associated with their transitory existence, that is, their "destined oblivion" (1971: 8); and finally, uncertainty arising from the barely imaginable dangers of their own possibility, however humdrum they may seem. Such possibilities led Foucault to make the following hypothesis: the production of abstractions is at once controlled and redistributed according to certain procedures whose role is to channel its powers; to cope with chance events; and to evade its ponderous forms of materiality. Gesturing to this procedural approach, I want to identify several conceivable starting points for this volume's abstractive agenda.

In the sections that follow, I identify three forms—Decay, Imagery, and Inflection—that comprise a partial typology of the kinds of abstractive industries emerging in the Arctic. *Decay* calls attention to the Anthropocene's emerging politics of difference whereby academics address the crucial position of the Arctic land/seascapes and coupled atmospheric systems as both indexing and accelerating global climate change. *Imagery* focuses on the concealment of production by industry and government whose efforts in calculative thinking summon together such "nondevelopments" as the rich visual displays of infrastructure that traffic in the denuding of the risk and peril of operations. Finally, *Inflection* calls attention to external discourses ("natural resources," "labor") that replace critical judgment on dispossession and exploitation thus giving rise to identitarian movements and critical ecologies. These three social configurations require material entities and competent agents engaged in valuation practices which I

refer to as "assembling the valuable and vulnerable" (see also Richardson and Weszkalnys 2014: 16).

My understanding of assembling emerged during the 2010s when I became witness to expert energy forecasts of the Russian Barents area. Development prospects included Exxon and Rosneft in the Kara region; Conoco and Lukoil in the Nenets; and Statoil and Rosneft in the Barents Sea. Conceptualizing the Barents energy future as concrete and knowable enabled disparate individuals to envision development through a simultaneity of time. Expectations (forecasts, scenarios) whether as real-time representations of future technological situations or as wishful enactments of desired futures (Borup et al. 2006) often serve as strategic resources for attracting attention from (financial) sponsors to stimulate agenda-setting processes (Van Lente 1993). Their policy adoption implicates standardization, investment decisions, and regulation. These informational spaces also comprise forms of assembly and circulation that fashion regions into *valuable* extractive frontiers. Building these values drew my attention to the recursive capacities of *internal* and *external* practices aimed at mobilizing and performing indicators and aesthetics, examples of which can be read throughout this volume's chapters.

Internal practices suggest assemblies of a wide range of data (models, data sets, algorithms) that give meaning to knowledge in the context of relationships with reference to practical understandings and IT systems (Knorr Cetina 1999). Information-sifting, for example, is selective and depends on high levels of embodied understandings involving years of experience (Wengle 2012). Alternatively, IT infrastructure such as Resource Planning systems employ a logic of conversion whereby the *Arctic* is converted into *knowledge* with the intention of *creating value*. While in the first instance internal practices render embodied knowledge explicit, in the second, technical systems redistribute calculative capacities from humans to machines (Knox et al. 2007).[1] Internal practices refer also to the way indicators and other practical data are mobilized through material and digital forms of knowledge and its deployment. These include reports, memos, scenarios, PowerPoint slides, and interaction. Artifactual data represent integrated packages that capture the activity of transforming information into knowledge that purports to have strategic value while its *present-ability* shapes what is transported externally (Bloomfield and Vurdubakis 2002).

By contrast, external practices call attention to the creation of communities of interpretation around abstractive knowledge. This includes forms of accountability aimed at legitimation. Scholars and advisory experts are increasingly forthcoming about their assembly processes,

pointing to the collective nature of their activity whereby they scrutinize each other's work. In the case of nonacademic expertise, assessments constitute emerging forms of privately provided public goods that are not always subject to independent scientific knowledge (McKenna 2006; Pollock and Williams 2010) but nevertheless have their own forms of accountability (Preda 2005). The structure of networking events for example, common among Arctic specialists until COVID-19, entail spatiotemporal features such as the division of the given time into plenary sessions that everyone can attend and parallel sessions that participants must choose among (Wallace n.d.). The allocation of individual and collective discussion through conferencing represents exemplary instances and instruments of future-management (Pollock and Williams 2015). In the case of Arctic hydrocarbon development, key networking events are settings of interdependencies among resource owners, contractors, regulatory and government officials, academics, and journalists. On display is a highly stylized economy of affects where knowledge is concentrated in forms of corporeality (Boyer 2005) that are central for the staging of verification and for circulating a repertoire of technical terms, acronyms, nonverbal signs, and other "judgment devices" that generate value (Karpik 2010), together with the contingency of this aim.

Thus, internal and external forms of mobilizing and performing mark the instantiation of new spaces of accumulation as well as a particular cultural formation for establishing the conditions of site-specific Arctic operations. By framing these spaces of value-shaping phenomena abstractively, we create dialogue on networked environmental effects and draw attention to the various infrastructures through which resources and representations are produced and circulated. Mapping the heterogenous complexes through which the Arctic is taking shape offers insight into how social adaptations to environmental effects unfold through complex social configurations perpetually constructed through assembly and predicated upon the confidence supplied by conjoining various types of knowledge (Çalışkan and Callon 2009). This is what I call the *Arctic abstractive* and to whose late industrial forms I now turn.

## Arctic Decay

The inevitability of loss and fascination with vulnerability are aesthetic structures that characterize the present-day Arctic. For the historian Sumathi Ramaswamy (2004: 1), these structures are central enough to the condition of the present that decay and deterioration are "good

to think in regard to what it means to be modern." Thus, the circumpolar North is becoming modern by unbecoming what it used to be.

Not so long ago, the Arctic was seen as fixed and fast-frozen with ice and snow that covered the region for most of the year. But today, the Land of the Midnight Sun is undergoing a kind of accelerated decay. The species of Arctic decay are many and often relate to environmental degradation, the most dramatic examples of which are disappearing sea ice and eroding coastlines. Driven by greenhouse gas emissions, the Arctic is heating up twice as fast as the rest of the planet. In many places, thawing permafrost—the frozen subsoil beneath the ice—is releasing stores of organic carbon, thereby amplifying the concentration of greenhouse gases in the atmosphere. As of this writing, a wave of wildfires is burning across the Siberian Arctic, sustained by all-time record temperatures of 38°C (100°F). These are just a few of the symptoms of climatically induced ecosystem change, a regime shift that is driving further changes through destabilizing feedback loops that threaten to turn the Arctic into an accelerator of global climate change.

But the articulation of Arctic ruin is not limited to physical, biogeochemical, and ecological processes. Crumbling infrastructure, declining security, and concern for a slipping away of culture suggests a more pervasive "endangerment sensibility," which Fernando Vidal and Nélia Dias (2015) associate with a network of concepts, values, and practices that are threatened with destruction along with the techniques aimed at preserving them.

Recently, in Norilsk, Russia's northernmost city, thawing ground caused an oil storage tank to collapse, pouring more than one hundred thousand barrels of diesel fuel into the Ambarnaya River: the largest spill ever to occur in the Russian Arctic (Kormann 2020). In Alaska, because sea ice no longer forms on the coastline, Native residents of Kivalina are fighting to keep their village—perched on land between the sea and a lagoon—from wasting away because of storms and tidal surges. Christine Shearer (2011) notes that Kivalina's destruction reflects a juridico-political process of climate denial, which reflects the same inequalities of power between communities and corporations that underpin processes of ruination in many global contexts (Navaro-Yashin 2012; Gordillo 2014; Dawdy 2016).

The environmental effects of land- and sea-based activity on the part of the region's oil and gas sector are well known. But the ongoing instability of global prices for Arctic oil may also be creating a sense of "ontological insecurity" (Dale, Veland, and Hansen 2019: 368), as defined by the undermining of a sense of identity and community.

Consider the eroding stability of the Russian Far North, where outmigration is turning villages into ghost towns (Heleniak 2010). The depopulation of once prosperous regions, such as the coal mining district of Vorkuta, has left residents without basic services and thrown urban viability into question, a type of deterioration that Elena Nuikina (2014: 10) calls "shrinkage."

Yet loss can also resonate with new possibilities that emerge from decay (Rico 2016). Indeed, for the sociologist Georg Simmel (1959: 261), the process of deterioration does not "sink the work of man into the formlessness of mere matter" but rather creates a new form "entirely meaningful, comprehensible, and differentiated." Liz Koslov (2016: 364), for example, counters the negative associations of coastal retreat to argue that it can be empowering for affected communities, finding in them a "positive potential for the process of giving in and giving up to prove reparative rather than harmful."

What are the politics of representation in this contested terrain? Whose stories are being pressed into service, and to what ends? In acknowledging the melting, off-gassing, buckling, and just plain falling apart throughout the region, scientists and national funding agencies have begun referring to the "New Arctic" (Doel, Wråkberg, and Zeller 2014). The phrase uncomfortably recalls the "New World," enacting a sort of intellectual imperialism that accompanies the renaming of a homeland. At the community level, the peril for local ecologies and people's lives is often expressed within an "everyday vernacular" (Callison 2014: 45) that exposes the gulfs between how Arctic residents experience their environment and how climate change is conveyed on the news. In the words of Mabel Toolie, a Native elder of St. Lawrence Island, Alaska, the Arctic is a place where "the Earth is faster now" (Krupnik and Jolly 2002: 7).

Georges Bataille (1997) observed that while progress is prized and achieved through productive activity, the principles of decay and loss are represented by unproductive expenditures: luxury, mourning, war. What designates unproductive forms is that these activities have no end beyond themselves. In this sense, observers of the New Arctic may be viewed as mourners over an unfolding, irreversible ruin. Bataille (1997: 176) qualifies himself, however, arguing that certain expenditures reflect the economic principle of "balance[d] accounts." One of his key illustrations is the institution of the *Potlach*, understood in terms of loss through the giving of considerable gifts—but with the goal of obligating a rival to return the gifts at a later time *and with interest*.

Similarly, executives, lobbyists, and speculators await the New Arctic with expectation, giving decay itself a sense of intention as envi-

ronmental change stands to do "work" for future accumulation. Here, it is fossil energy and its waste, the latter conceived as an externality, that operate as subsidies for capital. Greenhouse gases have set into motion a thermodynamic feedback mechanism that will grant access to new inputs for energy production in the Arctic, in what Leigh Johnson (2010: 835) has called an "iterative cycle of accumulation by degradation." In a perverse reworking of the neoliberal logic whereby the market seeks opportunity at the doorstep of every loss, firms and nations alike are aiming to turn environmental crisis into economic bonanza.

Hence, Arctic decay can be said to harbor the seed of possibility, whereby what was once inaccessible is now potential. As W. J. T. Mitchell (2001: 172) observes, "nothing falls apart, but things come alive. The modernist anxiety over the collapse of structure is replaced by the panic over the uncontrolled growth of structures." Peter Sloterdijk (1987: 151) has also written about the need "to unlock the positivity of the negative" and thus rethink the usefulness of the unuseful, the productivity of unproductivity, as if aversion and anxiety could be a threshold to other ways of knowing.

Perhaps the modernism of Arctic decay heralds the arrival of a new, properly differentiated structure of meaning. For now, amid the fog of Arctic evapotranspiration looms an answer to the question of what makes narratives of deterioration at once credible and incredible: Arctic decay can be said to represent the latest victory of capitalist modernity. What is no longer fixed and fast-frozen confirms that, following Marx, "all that is solid melts into air."

## Arctic Imagery

Public representations of the Arctic often include attention-grabbing visuals of the starving polar bear, melting ice cap, and offshore oil rig to depict Arctic biodiversity, climate change, and resource capture, respectively. While such visuals circulate before millions, seldom do they expand our understanding of the contests over meaning and power that underpin these charismatic images. Through their continual display, the Arctic is registered as a delicate, self-enclosed system threatened by global warming, as well as a sort of early-warning system whose indicators of environmental collapse fan cosmopolitan anxieties at lower latitudes. Such images do not carry the weight of accountability associated with written documents; generally, the identity of their creator is never specified. What they share, though,

is a sensuous quality that serves to mobilize aesthetic experience toward particular ends, often at the expense of acknowledging the lived realities of Arctic inhabitants (but see Shields 2019 for *The Guardian*'s statement on rethinking images of climate change).

Images of this sort are aesthetic abstractions, which researchers increasingly approach as devices that reroute the rational delivery of information through appeals to the senses (Ghosn 2012; Mason 2016; Jazairy et al. 2019). Recent work on the "Anthropocene-aesthetic-capitalist complex of modern visuality" (Mirzoeff 2014: 213) draws attention to the production of a sensory (anti)politics for validating matters of concern, or what Jacques Rancière (2004: 13) calls "the system of *a priori* forms determining what presents itself to sense experience."

One of my favorite visuals in this vein is a photograph of a rainbow descending into an Alaska mountain range, which appears as an inset in a US Geological Survey publication estimating that the Arctic holds 25 percent of the world's undiscovered oil and gas resources (Bird et al. 2008). This two-page fact sheet is one of the most frequently cited sources in academic, government, and media accounts of Arctic hydrocarbon estimates. Accompanying the photograph is the caption: "Overturned sedimentary rocks of the Lisburne Group [a geological formation] under a midnight rainbow." Here, alongside data points like 90 billion barrels of oil and 1,669 trillion cubic feet of natural gas appears a folkloric symbol that, in the Euro-American context, indexes a pot of gold at the end of the rainbow. Hydrocarbon development is thus subliminally framed in terms of a fortune whose discovery relies as much on luck, magic, and greed as it does on probabilistic methods of modeling and analysis.

In their treatment of economic abstractions, Alberto Toscano and Jeff Kinkle (2015: 29) refer to an "ocular-centric discourse" that recodifies and translates perceptions of risk into concepts of progress, a normalizing technique that is post-textual and, to some extent, post-*con*textual. One example they offer is of the energy company British Petroleum, which spent millions on rebranding itself as simply BP—initials that are now said to stand for "Beyond Petroleum," presented beside a yellow-and-green "solar earth" logo. In point of fact, BP's search for biomass-derived alcohol to replace fossil fuel in passenger cars has been "driving worldwide deforestation and the enclosure of millions of hectares of common land" (Toscano and Kinkle 2015: 245), as well as paving the way for a biofuel monoculture.

Aesthetic abstractions have an unmistakable link to the product defense industry, a term David Michaels (2008) uses to describe organizations whose aim is creating scientific doubt, delaying government

regulation, and affecting legal and judicial consciousness, thereby exposing growing numbers of people to potential harm. Christine Shearer (2011) shows with chilling detail the ability of historical and present-day industries to nurture widespread, dogmatic skepticism among segments of the general public, leading to a citizenry that is unconvinced of harm regardless of the weight of scientific evidence. Lobbying groups, energy companies, and other firms involved in producing, refining, or trading fossil fuels underwrite a specialized service sector that wields images in the vision of progress that their clients seek to promote (Mason 2019).

This sensibilization of debate over Arctic hydrocarbon development suggests that more is at stake than the specifics of any technical controversy (Kristoffersen and Langhelle 2017). The views of energy instantiated in five-year plans, promotional materials, and other industry artifacts amount to a visual appropriation of the Far North, which contributes in turn to a shift in popular understandings and policy choices (Bourmistrov et al. 2015; Vik 2017; Wilson, Hansen, and Rowe 2017). Accepting a particular representation of energy development both sets the terms for future discourse and defines the legitimate participants of political debate.

Aesthetic abstractions can also be understood as a sense-making faculty of vast techno-ontological systems. These mediate between ignorance and knowledge in complex ways, at times propagandizing but at other times capturing, assembling, and performing the complexity of the system's various forms. In this way, visualizations work to recursively diagnose systems and their breakdowns, depicting interactions that continually dissolve industrial forms and summon others into being. Thus, they embody key tensions associated with the modern integrated energy system and its transitions. Their growing centrality may, in fact, suggest the rise of a parallel production system, marked by an aesthetics of abstraction that are symptomatic of a detachment from material infrastructures of energy distribution.

Consider the futuristic images of the offshore Shtokman natural gas field, available on the internet, as envisioned by the Russian energy company Gazprom. In 2010, the Barents Sea was designated as a new energy region capable of contributing to EU energy security. In response to growing demands for oil, projected declines in existing supply, and the desire to protect imports from geopolitical conflicts between Russia and Ukraine, ambitious plans were drawn up and marked by images of a dramatically oversized scale.

Such images contrast with the proposed off-loading site, a town called Teriberka located several hours by dirt road from the Russian

city of Murmansk, which I visited in 2010 and found to be eerily similar to a Hollywood horror movie set in the ruined state of its buildings and roads—even as corporate sponsors assured residents that a renovated city would soon spring up. In this way, aesthetic abstractions create eyewitnesses to a version of modernity that exceeds its industrial inception in two respects: first, in spaces of indeterminancy (of what happened, what is happening, what will happen); and second, in a break between the subject and object relationship of witnessed events, where consciousness comes to be determined by the materiality of the image-being.

Increasingly, interactive representations of Arctic data further amplify both emotion and cognition. The digital outputs of GRID Arendal, an environmental communications center based in Norway, exemplify this turn toward multimedia abstraction of datasets that are too complicated to comprehend (Gautier et al. 2009; Schoolmeester et al. 2019). The humanities scholar Heather Houser (2014) has shown that such information visualizations can bring viewers to the point of "infogasm" through an allure of imagery that astonishes while also promising knowledge. This aesthetic register corresponds to a globalized mediascape in which data transparency aligns with misinformation and manipulation. Thus, Rania Ghosn (2012) highlights forms of erasure whereby representations exclude critical environmental conditions even while touting their own transparency. Wonderment at a technological complex bursting off the planet erases links between production and consumption, displacing the inevitable frictions encountered in making things flow.

## Arctic Inflection

Across the Arctic, internal and external conditions, forces, and circumstances write and rewrite the history of the region's Indigenous communities. The idea of a close-knit association between Indigeneity and sense of place is today being stretched, looped, and entangled into multi-sited identifications that originate in forced displacements and uprootings as well as the cosmopolitan imagination (Clifford 2013). Contemporary practices of belonging resist simple characterization, as with one-way accounts of the urbanization of rural life. The increased intensity of political practice around identitarian movements may also be seen as a conjuncture of Indigenous heritage and the turn toward corporate social responsibility, producing a kind of post–land-claims capitalist modernity on Native terms. Indigenous

becoming is now associated with new scales and dimensions of value that proliferate in a globally connected, locally inflected postmodernity (Hennessy, Smith, and Hogue 2018; Thisted 2020).

These shifting narratives of belonging involve questions of rights over the extraction of resources against the backdrop of colonial pasts and presents (Overland 2016; Tysiachniouk et al. 2018). For instance, the 2019 offer by US president Donald Trump to buy Greenland highlighted the annual block grant from Denmark in terms of its market value, putting a price on what nations are willing to pay in exchange for military and commercial presence in the Arctic. Similarly, benefit sharing between governments, private companies, and Indigenous peoples frames rights in a context of state ownership authorized to place restrictions on the use, management, and conservation of resources (Sulyandziga 2019; Raymond-Yakoubian et al. 2020). To paraphrase a key informant of mine, why do Alaska Natives not have the same authority over the resources in their territories that the *sheikhs* of Saudi Arabia do?

In this section, I revisit a key social science text written at a previous moment of restructuring in the energy industry to explore abstractions of Arctic Indigenous becoming in the context of rights over resources. In his widely admired *Arctic Politics*, political scientist Oran Young (1992) explains why it is unreasonable to expect the region's Indigenous peoples to return to a traditional life that is based solely on hunting and gathering. It is as if he inverts the trope of Robinson Crusoe—stuck on a deserted island and living like primitive man—to point out that, in the throes of late industrialism, his largely non-Indigenous readers harbor an unexamined commitment to having their Indigenous contemporaries take up the cause of living as such.

*Arctic Politics* has stood the test of time for its extraordinary attention to detail, relying in its argumentation on the singularity of example. Interwoven, throughout, is thoughtful reflection on the importance of self-governance for Arctic communities and the legacies of colonial violence. Thus, at one point in the book, Young (1992: 58) composes a list of goods and services that today's Arctic Indigenous peoples would be hard-pressed to do without, "from modern homes and television sets to modern education and sewage systems." All of these, Young supposes, entail participation in the cash economy through wage labor. Even if it were possible, Young (1992: 60) suggests a few pages later, returning to pure subsistence "would require a drastic restructuring."

Here, again, Young (1992: 60) reels off another list of consumer necessities to show how Arctic Indigenous peoples remain bound to

capitalism: "snow machines, all-terrain vehicles, pickup trucks, boats with gasoline engines, air transport, and high-powered rifles, along with the fuel and ammunition, heating oil, electricity, communications systems, health care facilities." But he goes on to pose a question that shifts his argument in a different direction: "And who is to say there is anything wrong with this?" (Young 1992: 60) On one reading, this passage presents Young's acceptance of a reality in which Indigenous peoples *could* and likely *should* live as wage laborers. But, on another, its attempt to deconstruct the primitive through a list of purchasable items serves to break the spell of primitive enchantment by substituting the vision of an alienated workforce under commodity capitalism. To borrow from the specialized language of Marxist thought (Sohn-Rethel 1978: 60–67), this is a *real* abstraction whereby a concrete reality is substituted for the abstract (labor-power), thereby enabling abstract determinations to take place in the concrete (as a wage laborer).

Stated less formally, the subsistence fantasy is an ideal whose abstractive work lays the grounds for ongoing colonial expropriation. It does so by abstracting Arctic peoples from modernity and identifying them with the primitivity of "pure subsistence." But, of course, the wage-labor alternative is also an ideal that lays the grounds for further appropriation. It does so by abstracting Arctic peoples from their ancestral right to land, including the minerals beneath the surface, and by identifying them as a workforce whose value consists in the labor they supply. Caught between these rival abstractions, Indigenous peoples in the Arctic are inventing new practices of signification and claim-making to assert their role as full participants in a modernity that must be articulated otherwise.

## Overview of the Chapters

This volume is organized around the myriad ways in which abstractions mediate ecological, political, technological, economic, and cultural inversions of value brought about by energy extraction in the Arctic. The chapters that follow examine, in one way or another, the transformation of vulnerability into forms of value, raising questions around how much we as humans can take from nature and who is entitled to define the future of the Arctic. The ordering of the chapters loosely follows an arch of involvement and detachment (Elias 1987) with proximities to a concreteness of politics. While the empirical terrain of this volume is national-circumpolar, the practices of assessing

vulnerability and deliberating over its value are relevant across different environmental systems and approaches to resource management around the globe (Kallis, Kiparsky, and Norgaard 2009; Lakoff 2016).

In "To Melt Away," Cymene Howe introduces the notion of abstractive sensing to grasp affective responses to climate change through the transforming landscapes and soundscapes of Iceland. The hidden destruction of the planet has reverberations in the everyday lives of those who make their homes in and around the Arctic, and sensing dramatic environmental changes proves central to understanding the interrelationship of humans and their contexts in times of technological and industrial acceleration.

Among the phenomenal forms that Howe charts is the death of a polar bear, which provokes outpourings of sentiment that are channeled in various hypermediated directions. These public affects call attention to impending extinction, as vanishing ice results in the disappearance of Arctic animals who rely on it. Dead bears become one way of sensing the diminishing cryosphere. In this way, melt serves as an indicator at various scales, from industrial society's dramatic alteration of the global climate to the individual sense of loss at the disintegration of landscapes that no longer wail with the sounds of glacial calving. Abstraction, here, points to an ominous "age of extreme asymmetry," as material mutations of ice underscore the realization that "humans are not the conductors of meaning" (Morton 2013: 164).

In "The Biggest, the Best, the Most, the Last," Danielle Dinovelli-Lang and Karen Hébert reveal the contradictory ways in which the future of life in Alaska now "hangs in the balance." We see extremes of both scarcity and abundance—the infestation of winter ticks that ravage moose, the resurgence of the endangered otter in numbers that threaten other aquatic animals—that can be attributed to climate change and extraction-related impacts. Meanwhile, the interests of Native Alaskans, scientists, game hunters, and conservationists give rise to official designations of vulnerability whereby novel forms of value cinch up with older resource regimes. Techniques like continuous monitoring bear the imprint of a resource-developmentalist vision for the future of animal populations. In this way, Alaska can be seen as a focal point where historically opposed visions of environmental protection and resource extraction converge in the invocation of nature's imperilment.

Like Howe, Dinovelli-Lang and Hébert employ the language of the extreme to call attention to forms of radical deterioration. For Howe, "extreme" refers to an ontological unraveling as the result of human

development, one whose meanings can no longer be managed through comforting abstractions of prediction and control. For Dinovelli-Lang and Hébert, "extreme" relates to imperatives for resource protection that result in a deepening of administrative control over local livelihoods—with the aim of maximizing value. Both chapters also offer visions of opposition. For Dinovelli-Lang and Hébert, radical deterioration signals both stewardship and exploitation; for Howe, it indexes new forms of understanding along with the tendency of meaning to collapse into disorder. Such extremes, noted Karl Marx (1992: 155), "cannot be mediated, precisely because they are real extremes. Nor do they have any need for mediation for their natures are wholly opposed. They have nothing in common with each other, they have no need for one another, they do not complement one another. The one does not bear within it a longing, a need, and anticipation of the other."

In "Timescaping the Arctic with Real-Time Data," Vidar Hepsø and Elena Parmiggiani consider digital assessments of risk mitigation in the context of oil development in Norwegian Arctic waters. They outline two approaches for assessing risk, computational sensing technologies and simulated models, both of which are capable of translating the complexity of the environment into measurable indicators. Such measures render adverse environmental impacts calculable for Norwegian authorities, research institutions, and commercial fisheries, while at least potentially supporting the developmental visions of the oil industry. Here, epistemological concerns over uncertainty are endowed with regulatory and economic implications.

Hepsø and Parmiggiani's chapter may be read in the context of the environmental management techniques described by Dinovelli-Lang and Hébert, whereby a projection of vulnerability promotes both stewardship and exploitation. Unlike state management in Alaska however, in Norway measures are undertaken by industry in collaboration with state authorities (Knol 2011). In this distinctly Scandinavian context, Hepsø and Parmiggiani suggest that the ideological requirements for participation among the different parties are based, at least in part, on an acceptance of the symbolic abstractions that their favored tools employ.

In "Wild Lands, Remote Edges," Mark Nuttall explores the ways in which geological assessments accumulate and enable judgment about opportunities for aligning natural resource development in remote locations within the global market. Today, extraction of minerals in Greenland is largely artisanal, while oil and gas development remains in the planning stages. Enthusiasm for large-scale extraction is lim-

ited in the face of technical and environmental challenges. Nonetheless, appeals to a global market index the appearance of the economy as external to and independent from Greenland's attempts to supply it with resources. Other scholars have interpreted this free-floating version of the market as one of the "fetishized figurations" (Lee and LiPuma 2002: 193) of collective agency that constitutes the social imaginary of modernity. This market acts in the world, causing events and creating effects as a third-person actor to which individuals respond but with which they do not necessarily identify.

For Nuttall, then, the global market is an abstraction that, following Howe, "represents no one person's unmediated experience (or observation) of the world, and yet [is] often recognized and accepted as real." Howe contrasts abstraction as an operation that produces knowable fragments, taking parts from wholes and rearranging them otherwise, to a practice of abstractive sensing that enacts its opposite. Similarly, Nuttall shows that abstractive sensing combines the enigmatic with the palpable, as with the effects of seismic surveys on narwhal behavior. While strict causation proves elusive, Nuttall notes that Greenlandic hunters are increasingly aware that the narwhal is restless (*katsungaarpoq*) and without peace (*eqqissinngilaq*), frightened as changes to sea ice agitate the environment.

In "Forging Off-World Frontiers," Mia M. Bennett examines China's expansion into the global North through the dynamics of supply and demand for iron ore and steel. As Bennett shows, the twin developments of iron mining across the Arctic and investment in steel-intensive infrastructures meant to provision these spaces constitute a "double frontier." Public and private investors take on huge capital costs as a forward-looking strategy for consolidating market position. Yet, given ongoing price volatility, the risks of investment can and often do lead to financial ruin and environmental degradation. Bennett's argument pushes past core-periphery analysis in showing that the agentive, impersonal global market described above can also function as a stand-in for China itself. Here, the double frontier is a double abstraction.

In their respective chapters, both Nuttall and Dinovelli-Lang and Hébert note the alien objectives of the market that decides which resources to develop on the basis of value maximization. Bennett describes Arctic iron ore being positioned for a generic global market with one important distinction—that this market, including its standards of modernization, transportation, and financialization, is actually the Chinese market. Thus, "the" market for Arctic ore is an abstraction that belies increasing hegemony of a single nation over

manufacturing, development, and capital export of large infrastructure systems.

In "Constructing and Contesting Temporalities in the Mackenzie Gas Project," Carly Dokis reflects on the way that oil companies assemble publics, not by reference to citizenship in a state, but through a possible relation to an emerging object: here, a natural gas pipeline. Her ethnographic research with the Sahtú Dene First Nations people of the present-day Northwest Territories details the biopolitical problem of how to respond to the concerns of specific populations living in the vicinity of disruptive development. There is a dark undercurrent of irony in their status as "necessary participants," which refers to eligibility for decision-making around resource extraction as a result of Canadian land claim agreements.

These scripted interactions resemble the "public-making" practices described by Andrew Barry (2013) in the context of the Baku-Tbilisi-Ceyhan (BTC) pipeline: a public discourse of information, procedures of environmental and social impact assessment, and stakeholder forums. The necessary participants in Barry's study make up a public that does not predate the proposed pipeline but is defined in terms of a fixed distance on either side of the route. Likewise, Dokis demonstrates how Canadian companies aim to contain dialogue within well-defined geographical limits or "baseline" conditions of communities and ecosystems. Yet she also grapples with how spatial limits abstract out from temporalities of concern, including colonial incursions into the lives of Dene people that include policies of assimilation and relocation, abrogation of treaties, and damage wrought by past extractive industries.

In "Material Unconscious of the Earth," Oxana Timofeeva provocatively casts oil development in the Russian Far North in terms of the metaphysical ideal of an eternal return, where energy can neither be created nor destroyed but only transformed. Under the sign of conservation, this ideal gives rationalist justification for bringing the forces of nature, including human nature, under control (see also Rabinbach 1992). Drawing on a heterodox corpus of literary texts and childhood impressions, Timofeeva theorizes late industrial value as the bearer of different natures, "confronted with dual or multiple obligations that are related and equally valued but incongruent" (Fortun 2001: 3).

As being itself is burned up alongside the substances that sustain it, a real opposition between life as value and life as living value loses distinction. In a material sense, modernity is consumed with consuming hydrocarbons with the aim of expanding a global economy. But in an ontological or abstractive sense, the global economy requires not

only burning everything up but doing so for the purpose of transforming it into the money-form.

In "Representation without Resemblance," I examine the way facts are culturally made social through an energy visual type—the graph—whose popularity as an inscription device constitutes a style of aesthetics that celebrates abstractness. Drawing on classical representation as a work of resemblance, I argue that the underlying trait of the graph is transposition whereby assimilation between ideas occurs through distanced reflection. Moreover, by perpetuating hesitation through perception, the graph imposes a new kind of refinement or social habitus of detachment that is associated with designs of the modern energy complex. In this manner, the graph is a material development with a range of viewpoints for facilitating patterns of reflexivity considered essential to the development of commodity energy management. As such, energy graphs are manifestations of a new deregulated stage of energy procurement. Not incidentally, their appearance in Alaska disrupts a process of fixed involvement in the knowledge and emotional economy of hydrocarbon development by rendering politics regressive for market-based extraction. What politicians and economists do with the graph is, of course, susceptible to professional evaluation. But in the cultural process that I describe, the energy graph becomes naturalized as a mode of experience whose abstractness is beyond reproach.

Finally, in his "Afterword: Arctic Abstractions," Michael J. Watts offers a spell-binding journey through a raft of vantage points on the contradictions and possibilities of abstractionist aims. With a hurried step, articulations of the abstraction-extraction interface on social relations (alienation, intellectual fragmentation) and material consequences (labor power, human agency) run headlong into a newly emerging "Digital Arctic"—defined as much by the massive, irreversible phase changes in the material composition of the Arctic Ocean as by the demands for its representation at multiple scales through new systems of satellites, drones, cables, supercomputers, and sensors. As Nicole Starosielski (2015: 17) notes in *The Undersea Network*, distinguishing spaces of digital distribution requires materialities of design and finance by companies invested in conflicting operations of interest. At the center of this new digital ocean—where geo-economic and geostrategic value inheres in its rendering as a calculative, computational domain—is the building of a logistics space for the Anthropocene via a new frontier of accumulation, a "trillion-dollar ocean."

In fact, the Afterword thickens, enlivens, and hurries along my own modest steps toward an introductory framing of abstractive industry.

It may also be considered the first concrete object created in response to the production of this volume. As such, if the chapter by Watts is an indicator of what this volume might inspire in others, then indeed the work (and wait) of authors herein has been justified.

Taken together, these chapters contribute to the social studies of energy and climate by framing the concept of *abstraction* as an insignia of structural effects and the principle of technological exploitation of nature—to treat everything as raw material to be transformed into money. Hence, symbolic practice denies the sphere of material production its autonomy while at the same time rendering it possible for production to be extended to every part of the planet, including the Arctic.

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## Notes

1. The STS scholar Antti Silvast has reminded me in personal conversation that such machineries of knowledge production create epistemic subjects that are derivative of machineries or erased altogether.

## References

Appadurai, Arjun. 1986. "Introduction: Commodities and the Politics of Value." In *The Social Life of Things: Commodities in Cultural Perspective*, edited by Arjun Appadurai, 3–64. New York: Cambridge University Press.

Barry, Andrew. 2006. "Technological Zones." *European Journal of Social Theory* 9(2): 239–53.

———. 2013. *Material Politics: Disputes along the Pipeline*. Malden: Wiley-Blackwell.

Bataille, Georges. 1997. "The Notion of Expenditure." In *The Bataille Reader*, edited by Fred Botting and Scott Wilson, 167–82. Malden: Blackwell.

Baudrillard, Jean. 1981. *For a Critique of the Political Economy of the Sign*. Translated by Charles Levin. Originally published in French, 1972. St. Louis: Telos.

Bird, Kenneth J. and Ronald R. Charpentier, Donald L. Gautier (CARA Project Chief), David W. Houseknecht, Timothy R. Klett, Janet K. Pitman, Thomas E. Moore, Christopher J. Schenk, Marilyn E. Tennyson, and Craig J. Wandrey. 2008. Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle. U.S. Geological Survey Fact Sheet 2008-3049.

Bloomfield, Brian, and Theo Vurdubakis. 2002. "The Vision Thing: Constructing Technology and the Future in Management Advice." In *Critical Consulting: New Perspectives on the Management Advice Industry*, edited by Timothy Clark and Robin Fincham, 115–29. Oxford: Blackwell.

Borup, Mads, Nik Brown, Kornelia Konrad, and Harro Van Lente. 2006. "Sociology of Expectations in Science and Technology." *Technology Analysis and Strategic Management* 18(3/4): 285–98.

Bourmistrov, Anatoli, Frode Mellemvik, Alexei Bambulyak, Ove Gudmestad, Indra Overland, and Anatoly Zolotukhin, eds. 2015. *International Arctic Petroleum Cooperation: Barents Sea Scenarios*. New York: Routledge.

Boyer, Dominic. 2005. "The Corporeality of Expertise." *Ethnos* 70(2): 243–66.

Brick, Howard. 1992. "Optimism of the Mind: Imagining Postindustrial Society in the 1960s and 1970s." *American Quarterly* 44(3): 348–80.

Bridge, Gavin. 2009. "The *Hole* World: Scales and Spaces of Extraction." *New Geographies* 2: 43–48.

Çalışkan, Koray, and Michel Callon. 2009. "Economization, Part 1: Shifting Attention from the Economy towards Processes of Economization." *Economy and Society* 38(3): 369–98.

Callison, Candis. 2014. *How Climate Change Comes to Matter: The Communal Life of Facts*. Durham, NC: Duke University Press.

Clifford, James. 2013. *Returns: Indigenous Becoming in the Twenty-First Century*. Cambridge, MA: Harvard University Press.

Dale, Brigt, Siri Veland, and Anne Merrild Hansen. 2019. "Petroleum as a Challenge to Arctic Societies: Ontological Security and the Oil-Driven 'Push to the North.'" *Extractive Industries and Society* 6: 367–77.

Davis, Heather, and Etienne Turpin 2015. "Art and Death: Lives Between the Fifth Assessment and the Sixth Extinction." In *Art in the Anthropocene: Encounters among Aesthetics, Politics, Environments, and Epistemologies*, edited by Heather Davis and Etienne Turpin, 3–29. London: Open Humanities Press.

Dawdy, Shannon Lee. 2016. *Patina: A Profane Archaeology*. Chicago: University of Chicago Press.

Doel, Ronald E., Urban Wråkberg, and Suzanne Zeller. 2014. "Science, Environment, and the New Arctic." *Journal of Historical Geography* 44: 2–14.

Douglas, Mary. 1966. *Purity and Danger: An Analysis of Concepts of Pollution and Taboo*. New York: Routledge.

Easterling, Keller. 2016. *Extrastatecraft: The Power of Infrastructure Space*. New York: Verso.

Edwards, Paul N. 2010. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. Cambridge, MA: MIT Press.

Elias, Norbert. 1987. *Involvement and Detachment.* Oxford: Blackwell.

Fortun, Kim. 2001. *Advocacy after Bhopal: Environmentalism, Disaster, New Global Orders*. Chicago: University of Chicago Press.

———. 2012. "Ethnography in Late Industrialism." *Cultural Anthropology* 27(3): 446–64.

Foucault, Michel. 1971. "Orders of Discourse." *Social Science Information* 10(2): 7–30.

Gautier, Donald et al. 2009. "Assessment of Undiscovered Oil and Gas in the Arctic." *Science* 324: 1175–79.

Ghosn, Rania. 2012. "Where are the Missing Spaces? The Geography of Some Uncommon Interests." In *Agency*, edited by Kurt Evans, Iben Falconer, and Ian Mills, 109–16. New Haven: Yale School of Architecture.

Gordillo, Gastón R. 2014. *Rubble: The Afterlife of Destruction*. Durham, NC: Duke University Press.

Haarstad, Håvard, and Tarje Wanvik. 2017. "Carbonscapes and Beyond: Conceptualizing the Instability of Oil Landscapes." *Progress in Human Geography* 41(4): 432–50.

Hall, Stuart. 1992. "The West and the Rest." In *Formations of Modernity*, edited by Stuart Hall, 276–320. Cambridge: Polity Press.

Heleniak, Timothy. 2010. "Population Change in the Periphery: Changing Migration Patterns in the Russian North." *Sibirica* 9(3): 9–40.

Helmreich, Stefan. 2011. "From Spaceship Earth to Google Ocean: Planetary Icons, Indexes, and Infrastructures." *Social Research* 78(4): 1211–42.

Hennessy, Kate, Trudi Lynn Smith, and Tarah Hogue. 2018. "ARCTICNOISE and Broadcasting Futures: Geronimo Inutiq Remixes the Igloolik Isuma Archive." *Cultural Anthropology* 33(2): 213–23.

Houser, Heather. 2014. "The Aesthetics of Environmental Visualizations: More than Information Ecstasy?" *Public Culture* 26(2): 319–37.

Jazairy, El Hadi, Rania Ghosn, Jia Weng, Rawan Al-Saffar, Kartiki Sharma, Hsin-Han Lee, Namjoo Kim, and Sihao Xiong. 2019. "After Oil." *Design Earth*. Retrieved May 1, 2020, from https://design-earth.org/projects/after-oil.

Johnson, Leigh. 2010. "The Fearful Symmetry of Arctic Climate Change: Accumulation by Degradation." *Environment and Planning D* 28(5): 828–47.

Kallis, Giorgos, Michael Kiparsky, and Richard Norgaard. 2009. "Collaborative Governance and Adaptive Management: Lessons from California's CALFED Water Program." *Environmental Science and Policy* 12(6): 631–43.

Karpik, Lucian. 2010. *Valuing the Unique*. Princeton: Princeton University Press.

Kinder, Jordan, and Lucie Stepanik, eds. 2020. "Oil and Media, Oil as Media: Mediating Petrocultures Then and Now." Special issue, *MediaTropes* 7(2).

Knol, Maaike. 2011. "The Uncertainties of Precaution: Zero Discharges in the Barents Sea." *Marine Policy* 35: 399–404.

Knorr Cetina, Karin. 1999. "Epistemic Cultures: How the Sciences Make Knowledge." Cambridge, MA: Harvard University Press.

Knox, Hannah, Damian O'Doherty, Theo Vurdubakis, and Chris Westrup 2007. "Transformative capacity, information technology, and the making of business 'experts.'" *The Sociological Review* 55(1): 22–41.

Kormann, Carolyn. 2020. "A Disastrous Summer in the Arctic." *New Yorker*, 27 June.

Koslov, Liz. 2016. "The Case for Retreat." *Public Culture* 28(2): 359–87.

Kristoffersen, Berit, and Oluf Langhelle. 2017. "Sustainable Development as a Global Arctic Matter: Imaginaries and Controversies." In *Governing Arctic Change: Global Perspectives*, edited by Kathrin Keil and Sebastian Knecht, 21–41. New York: Palgrave Macmillan.

Krupnik, Igor, and Dyanna Jolly, eds. 2002. *The Earth Is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks: Arctic Research Consortium of the United States.

Lakoff, Andrew. 2016. "The Indicator Species: Tracking Ecosystem Collapse in Arid California." *Public Culture* 28(2): 237–59.

Lee, Benjamin, and Edward LiPuma. 2002. "Cultures of Circulation: The Imaginations of Modernity." *Public Culture* 14(1): 191–213.
Marx, Karl. 1992. "Critique of Hegel's Doctrine of the States." In *Early Writings*, translated by Rodney Livingstone and Gregor Benton, 57–198. New York: Penguin.
Masco, Joseph. 2010. "Bad Weather: On Planetary Crisis." *Social Studies of Science* 40(1): 7–40.
Mason, Arthur. 2008. "Vanguard Heritage Practice and the Import of Expertise." *Inuit Studies* 32(2): 107–25.
———. 2016. "Arctic Energy Image: Hydrocarbon Aesthetics of Progress and Form." *Polar Geography* 39(2): 130–43.
———. 2019. "Consulting Virtue: From Judgment to Decision Making in the Natural Gas Industry." *Journal of the Royal Anthropological Institute* 25(S1): 124–39.
McKenna, Christopher. 2006. *Management Consulting in the Twentieth Century*. Cambridge, UK: Cambridge University Press.
Michaels, David. 2008. *Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health*. New York: Oxford University Press.
Mirzoeff, Nicholas. 2014. "Visualizing the Anthropocene." *Public Culture* 26(2): 213–32.
Mitchell, Timothy. 2012. *Carbon Democracy: Political Power in the Age of Oil*. New York: Verso.
Mitchell, W. J. T. 2001. "Romanticism and the Life of Things." *Critical Inquiry* 28(1): 167–84.
Morton, Timothy. 2013. *Hyperobjects: Philosophy and Ecology after the End of the World*. Minneapolis: University of Minnesota Press.
Navaro-Yashin, Yael. 2012. *The Make-Believe Space: Affective Geography in a Postwar Polity*. Durham, NC: Duke University Press.
Nuikina, Elena. 2014. "Making a Viable City: Visions, Strategies, and Practices." PhD diss., University of Vienna.
Overland, Indra. 2016. "Ranking Oil, Gas and Mining Companies on Indigenous Rights in the Arctic." In *Indigenous People and Resource Extraction in the Arctic: Evaluating Ethical Guidelines*. Tysfjord, Norway: Árran Lule Sámi Centre.
Pollock, Neil and Robin Williams. 2010. "The Business of Expectations: How Promissory
Organizations Shape Technology and Innovation". *Social Studies of Science* 40(4) 525–48.
———. 2015. The Venues of High Tech Prediction: Presenting the Future at Industry Analyst Conferences. *Information and Organization*, 25:115–36.
Preda, Alex. 2005. "Legitimacy and Status Groups in Financial Markets." *British Journal of Sociology* 2 (56/3): 451–71.
Rabinbach, Anson. 1992. *The Human Motor: Energy, Fatigue, and the Origins of Modernity*. Berkeley: University of California Press.
Rancière, Jacques. 2004. *Politics and Aesthetics*. Translated by Gabriel Rockhill. New York: Continuum.
———. 2015. "The Concept of 'Critique' and the 'Critique of Political Economy.'" In *Reading Capital: The Complete Edition*, translated by Ben Brewster and David Fernbach, 73–174. New York: Verso.

Ramaswamy, Sumathi. 2004. *The Lost Land of Lemuria: Fabulous Geographies, Catastrophic Histories*. Berkeley: University of California Press.

Raymond-Yakoubian, Julie, Peter L. Pulsifer, D. R. Fraser Taylor, Camilla Brattland, and Tero Mustonen. 2020. "Mapping and Indigenous Peoples in the Arctic." In *Governing Arctic Seas: Regional Lessons from the Bering Strait and Barents Sea*, edited by Oran R. Young, Paul Arthur Berkman, and Alexander N. Vylegzhanin, 293–319. New York: Springer.

Richardson, Tanya, and Gisa Weszkalnys. 2014. "Resource Materialities." *Anthropological Quarterly* 87(1): 5–30.

Rico, Trinidad. 2016. *Constructing Destruction: Heritage Narratives in the Tsunami City*. New York: Routledge.

Schoolmeester, Tina, Hanna Lønning Gjerdi, John Crump, Björn Alfthan, Joan Fabres, Kathrine Johnsen, Laura Puikkonen, Tiina Kurvits, and Elaine Baker. 2019. *Global Linkages: A Graphic Look at the Changing Arctic*. Nairobi: United Nations Environment Programme and GRID-Arendal.

Shearer, Christine. 2011. *Kivalina: A Climate Change Story*. Chicago: Haymarket Books.

Shields, Fiona. 2019. "Why We're Rethinking the Images We Use for Our Climate Journalism." *Guardian*, 18 October.

Simmel, Georg. 1959. "The Ruin." In *Essays on Sociology, Philosophy and Aesthetics*, edited by Kurt H. Wolff, 259–66. Columbus: Ohio State University Press.

Sloterdijk, Peter. 1987. *Critique of Cynical Reason*. Translated by Michael Eldred. Minneapolis: University of Minnesota Press.

Sohn-Rethel, Alfred. 1978. *Intellectual and Manual Labor: A Critique of Epistemology*. London: Macmillan.

Starosielski, Nicole. 2015 *The Undersea Network*. Durham, NC: Duke University Press.

Sulyandziga, Liubov. 2019. "Indigenous Peoples and Extractive Industry Encounters: Benefit-Sharing Agreements in Russian Arctic." *Polar Science* 21: 68–74.

Thisted, Kirsten. 2020. "Politics, Oil, and Rock 'n' Roll: Fictionalising the International Power Game about Indigenous People's Rights and the Fight over Natural Resources and Financial Gain in the Arctic." In *The Postcolonial North Atlantic: Iceland, Greenland and the Faroe Islands*, edited by Lill-Ann Körber and Ebbe Volquardsen, 329–61. Berlin: Nordeuropa-Institut der Humboldt-Universität.

Thomas, Nicholas. 1991. *Entangled Objects: Exchange, Material Culture, and Colonialism in the Pacific*. Cambridge, MA: Harvard University Press.

Toscano, Alberto. 2008. "The Culture of Abstraction." *Theory, Culture and Society* 25(4): 57–75.

———. 2015. "The Detour of Abstraction." *Diacritics* 43(2): 68–90.

Toscano, Alberto, and Jeff Kinkle. 2015. *Cartographies of the Absolute*. Winchester: Zero Books.

Tsing, Anna Lowenhaupt, Heather Anne Swanson, Elaine Gan, and Nils Bubandt, eds. 2017. *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene*. Minneapolis: University of Minnesota Press.

Tysiachniouk, Maria, Laura Henry, Machiel Lamers, and Jan P. M. van Tatenhove. 2018. "Oil and Indigenous People in Sub-Arctic Russia: Rethinking Equity

and Governance in Benefit Sharing Agreements." *Energy Research and Social Science* 37: 140–52.
Van Lente, Harro. 1993. *Promising Technology*. Amsterdam: Proefschrift.
Vidal, Fernando, and Nélia Dias. 2015. "Introduction: The Endangerment Sensibility." In *Endangerment, Biodiversity and Culture*, edited by Fernando Vidal and Nélia Dias, 1–48. New York: Routledge.
Vik, Synnøve Marie. 2017. "Petro-Images of the Arctic and Statoil's Visual Imaginary." In *Arctic Environmental Modernities: From the Age of Polar Exploration to the Era of the Anthropocene*, edited by Lill-Ann Körber, Scott MacKenzie, and Anna Westerståhl Stenport, 43–58. New York: Palgrave Macmillan.
Wallace, Derek. n.d. "Temporalizing the Instruments for Managing the Future: The New Zealand Case." Unpublished manuscript in Microsoft Word file.
Watts, Michael. 2012. "The Tale of Two Gulfs: Life, Death, and Dispossession along Two Oil Frontiers." *American Quarterly* 64(3): 437–67.
Wengle, Suzanne. 2012. "Engineers Versus Managers." *Economy and Society* 41(3): 435–67.
Weszklanys, Gisa. 2015. "Geology, Potentiality, Speculation: On the Indeterminancy of First Oil." *Cultural Anthropology* 30(4): 611–39.
Wilson, Emma, Anne Merrild Hansen, and Elana Wilson Rowe. 2017. "Imagining the Future: Local Perceptions of Arctic Extractive Industry Projects that Didn't Happen." In *Arcticness: Power and Voice from the North*, edited by Ilan Kelman, 130–49. London: UCL Press.
Wilson, Sheena, Imre Szeman, and Adam Carlson. 2017. "On Petrocultures: Or, Why We Need to Understand Oil to Understand Everything Else." In *Petrocultures: Oil, Politics, Culture*, edited by Sheena Wilson, Adam Carlson, and Imre Szeman, 3–20. Montreal: McGill-Queen's University Press.
Young, Oran R. 1992. *Arctic Politics: Conflict and Cooperation in the Circumpolar North*. Hanover, NH: Dartmouth College Press.
Žižek, Slavoj. 1989. *The Sublime Object of Ideology*. New York: Verso.

CHAPTER 1

# To Melt Away

## *Abstractive Sensations in Ice*

Cymene Howe

In recent years, ice has become a climatological signal: a substance that renders visible rising temperatures brought about by anthropogenic climate change. Ice can be measured, its retreats photographed, its depths plumbed and its duration—or lifespan—calculated. And it is melting: nowhere faster (and faster than expected) than in the Arctic region.[1] Melting ice is now understood as the key index that polar temperatures are increasing dramatically according to the Intergovernmental Panel on Climate Change (IPCC), taking glacial diminishment to be the "highest confidence temperature indicator in the climate system" (Houghton et al. 2001). Greenland's ice sheet, which is only one tenth the size of Antarctica, is currently contributing twice as much to overall sea levels[2] and scientists have concurred that the rate of melt in polar zones has been considerably underestimated.[3] The 2017 Arctic Monitoring and Assessment Programme report[4] details that global sea levels will rise much more quickly than previously thought with new estimates almost double the pace predicted by the IPCC in 2013. Ice's physical changes and the geohydrological implications associated with it have now become regular media features as news of catastrophic melt continues to mark our times. The mutations of the world's ice, and the implications of these cryohuman processes serve as powerful indicators of what we might call, not just an "Age of Asymmetry," (Morton 2013: 161) but an Age of Extreme Asymmetry.

Iceland is an important locus for understanding climate change because few places have had more glacial retreat or experienced melt more dramatically than Iceland. Ten percent of the country's surface is covered by glaciers, and it is home to the largest ice cap in Europe, Vatnajökull. Since settlement in 874, glaciers have played an important role in Iceland's history and culture, often as a dangerous presence threatening to displace villages with encroachment and massive outburst floods (Jóhannesson 2005).[5] Because of climate change, however, the cultural meaning of glaciers appears to be changing. Bodies of ice that were once threats are now vulnerable and in need of care. Iceland's more than four hundred glaciers now lose eleven billion tons of ice per year[6] and scientists have predicted that by the end of the twenty-first century all of Iceland's glaciers will be gone.

The Arctic Circle barely touches Iceland,[7] but the country has centered itself politically as an influential member of the Arctic Council states.[8] With the advance of climate change, the Arctic has also become a site for security concerns, a "new Cold War" zone in the once-frozen North (Heininen 2015). The region's future is increasingly cast in relation to the activities of two Cold War protagonists, China and Russia. A gold rush mentality has also come to occupy the region as new shipping routes are cleared by the loss of sea-ice and mineral stores become more accessible by the disappearance of ice on land and sea (Bertelsen and Graczyk 2016; Pincus and Ali 2015). The logistics hub for the Northern Sea Route[9] may be constructed in northern Iceland and within the coming decades several Arctic shipping passages are expected to be entirely free of sea ice year-round. As ice recedes on land and on the ocean's surface, hydrocarbon exploration and extraction will almost certainly increase, although little infrastructure is in place to treat oil spills or other accidents if 25 percent of the world's remaining carbon fuel reserves are unearthed in the Arctic region.

## The Social Life of Ice

Social scientists have long explored how ice and human populations have interacted. Franz Boas, who is considered the "father" of American anthropology, created detailed studies of Inuit people's relationship to ice in the late nineteenth century (Boas 1888).[10] More recently, anthropologists and others (Grossman and Parker 2012) have begun chronicling Indigenous people's experiences with climate change in arctic zones and among those who live near glaciers and ice-covered

**Figure 1.1.** | *Glacial lagoon. Jökulsárlón, East Iceland, 2016.*
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peaks (Crate and Nuttall 2009; Cruikshank 2006; Marino 2015; Nuttall 2009; Rhoades, Zapata, and Aragundy 2008). These narratives reveal deep concerns about retreating ice among First Nations people and subsistence hunters who rely on seasonal freezing and ice pack for their livelihoods. Responses to melting cryospheres, however, are not singularly negative. Some Greenlanders have been embracing ice reduction because it will increase access to mineral and hydrocarbon resources (Nuttall 2009, 2015, 2016). Several Icelandic politicians have likewise celebrated the possible economic windfall of the great melting, arguing that warmer conditions represent a boon for northern nations because this will make agricultural and resource extraction more practical and economically viable. Given the rapidity of climate-induced melting and its resulting impacts, it is important that we understand the effects of cryospheric diminishment in the frozen places where ice has dominated landscapes, shaped lives, and conditioned encounters with land, resources, and livelihoods (Harwood et al. 2011).

This chapter is based on my anthropological research over the last several years, where I have been trying to understand how ice's ma-

terial form is changing, moving, and presencing differently among Icelanders and within the ecosystems they inhabit. I began with the proposition that ice is conditioned by both ecological and economic inputs and that melting cryospheres will be experienced differently by differently positioned subjects, over time and space. My thinking about what I now call "cryohuman" relationships has drawn inspiration from several intersecting debates in the social sciences concerning climate change, environmental conditions, and adaptation responses to the Anthropocene (Barnes et al. 2013; Chakrabarty 2009). Some scholars have been interested in how industry (Linnenluecke and Griffiths 2015), security (Heininen 2015), and markets must now attend to unprecedented shifts in our earth system (Zolli and Healy 2013), especially as the number of climate refugees and the frequency of migrations increase at home and abroad. Infrastructural responses to ecological changes (Strauss and Orlove 2003; Watson and Adams 2010) have also shown that initial responses may not be sustainable as climate and weather phenomena become more virulent in the future (Edwards 2010; Hulme 2011).

Climate change is not limited to its political and economic impacts, or its effects upon (only) human populations. For this reason, I take a cue from Donna Haraway (2015) who calls us to attend to multiple kinds of "response-ability": the affective capacity to recognize the interfolding of human lives among a multiplicity of beings and inanimate forms. She is interested in our ability to "respond" to the intimate relationships between ourselves and other-than-human entities including glaciers, ice sheets, and sea ice. The capacity to sense dramatic environmental changes has been central to understanding the relationship between humans and our living contexts, particularly in times of technological and industrial accelerations (Parr 2010). As Kathleen Stewart (2007) has shown, subtle permutations in a known place—the scent of trees and blossoms or the smell of gasoline and rancid meat—can result in a powerful affective reaction among those who have inhabited locations for long periods of time and are attuned to quotidian changes in their atmospheres. In this chapter, I draw together a range of responses to melt by centering attention on how humans, and nonhuman others, experience abstractive moments of sensory engagement through a melting cryosphere. The term "abstractive," as this volume illustrates, serves as a conceptual frame to "render embodied knowledge explicit" by redistributing empirical capacities from humans to technical systems and, I would add, other-than-human actors (Mason 2016). Melt, I will argue, offers an assemblage of abstractive encounters that make climate change ex-

plicit, demonstrating the multiple ways that climatic conditions are sensed, experienced, and known by human populations but not limited to them.

## On Extinctions, One Animal at a Time

This chapter began with the proposition that ice has become a signal for rapidly transforming environmental systems, or a "climatological canary in the coalmine." But before receding glaciers or melting ice sheets came to occupy much of the popular imagination around climate change, there was another charismatic figure of demise: the polar bear.

Dead bears are one way of abstracting melt.

Egill Bjarnason was the first to spot the bear just outside the northwestern Icelandic town of Sauðárkrókur in the summer of 2016. He was in no doubt that it needed to be killed immediately, as it was close to a farm where children had been playing. This was the first polar bear to have come ashore in Iceland since 2010. The bears are not native to the island, but they drift over on sea ice or swim from Greenland as their own cryoscapes elapse. After the bear's carcass was dissected it was clear that the female bear had been both swimming for many miles as well as floating on drift ice. The shortest distance between Greenland and Iceland is three hundred kilometers. But the distance between Greenland and the shore where this polar bear was first seen is considerably longer, about six hundred kilometers. The bear was also a mother who was still lactating, so it couldn't have been long since she was accompanied by her cubs.

Throughout recorded history there have only been a few hundred recorded sightings of polar bears in Iceland. The oldest of these was in 890, sixteen years after the first settlers arrived on the island. During the Middle Ages, polar bears were frequently tamed; but since that time, no bear has been captured alive in Iceland. For several decades, it has been national policy in Iceland to kill polar bears on sight as they are inevitably hungry after their sea voyage and therefore considered a danger to residents and livestock.

The shooting of the mother bear induced a rather vivid outpouring of affect across the country in the days that followed, seen especially on social media sites like Facebook. Reactions were divided along two general lines: either Icelanders must protect themselves and their

livestock and, being that the bears come ashore hungry in remote parts of the island, it is up to local farmers or marksmen to ensure the safety of local residents; or, Icelanders ought to revisit this policy and put into place more humane responses to bear landings given that they will likely increase with the continuation of climate-induced melting on and around neighboring Greenland. Jon Gnarr, the former mayor of Reykjavík, who had run (partly facetiously) on a platform that included hosting a polar bear at the Reykjavík zoo, saw future bear migrations as a potential boon for the country. "Why not make a tourist attraction of a polar bear haven?" he asked. Jon Gunnar Ottosson, head of the Icelandic Institute of Natural History, along with many others, also decried the shooting of the bear, saying that it could have been shot with a tranquillizer rather than killed. (Officials contended that it would have taken an hour by plane to get the tranquilizers to the site and that it would have been impossible to keep track and control over the animal for that long). A spokesman for PolarWorld, a German group dedicated to the preservation of the polar regions and the creatures that inhabit it, called the bear's death "an avoidable tragedy," adding, in full irony, "this is another great day for mankind."

The circulation of the polar bear's story in both conventional and social media, and the international response to it, is indicative of a hypermediated communicational context where responses—affective and discursive—are able to spread quickly and with great reach. A platform such as Facebook, which is extremely popular in Iceland (and used by approximately three quarters of the population) allows for a particularly public affective response; it serves to promote structures of feeling across both a national and an international imaginary. In its digitized retelling, and in the collective human warnings and mourning that the bear's story evoked, there is evidence of further abstractions.[11] These are the abstractions of sentiment that channel one animal's plight in one or another political direction: indicating either the failure of "mankind" to preserve ecosystemic integrity, or the prioritization of human lives over all others. In both cases, the "meme-ification" of the bear's tale performs its own kind of abstraction, including as a signal of atmospheric and cryospheric transformations. The bear's death provoked emotive responses from many humans that were touched by it, but more than this, it drew attention to the diminishing cryosphere that was the cause of her journey and ultimately, her demise. Dead bears are one way of recognizing lost ice.

## The Lost Sound of Sea Ice

Helga Edmundsdóttir remembers the sea ice when she was a girl growing up in a little village in the northwest of Iceland. It terrified her at night. Ghostly moans were emitted as floating mountains of ice rubbed up against each other, aching out a frictional chorus. That is heard much, much less now. "These days," Helga explained, "I hardly ever hear that screeching sound of ice at sea. Or the sounds of it hitting up against the ships in the harbor. And while it scared me then, I do miss it now." Lacking the eerie sound of sea ice, the Icelandic coasts are quieter than before. Silence then, can be taken as further confirmation of a melting north. This sonic disintegration is a sign too of wider, darker seas and coastlines more sparsely dotted with drifts of fresh water. Since sea ice also serves as bulwark and barrier to storm waves and the erosive powers of the world's oceans upon glaciers and ice sheets, the silencing of sea ice is also a signal of more disintegrations to come.

Sea ice, which forms and melts each year, has declined more than 30 percent in the past twenty-five years. In November of 2016, ice levels hit a record low, causing Artic climate experts to declare that "we are now in 'uncharted territory.'"[12] "The trend has been clear for years," explained one, "but the speed at which it is happening is faster than anyone thought." Unlike on the Antarctic continent, melting sea ice in the Arctic exposes dark, open ocean beneath, absorbing more sunlight and thus warming faster. Dark waters absorb heat and the reflective "albedo" effect, in which sunlight is reflected off the surface of white ice sheets and glaciers, is also reduced with each phase of melt. This, in addition to weather patterning, is why the Arctic is heating up much faster than the rest of the planet, about twice as fast as in the temperate latitudes, or by some estimates, as much as four times as much. Melting sea ice as well as land-based ice is affecting weather systems all over the world, especially as ocean currents and conveyors are modified by both hotter water and the influx of fresh meltwater into saltwater oceanic systems.

## Glacial Response

Guðfinna Aðelgeirsdóttir has just returned from Sólheimajökull, a glacial tongue about two hours southeast of Reykjavík. Guðfinna teaches a glaciology class for exchange students in addition to her regular re-

search and teaching as a professor at the University of Iceland. Each year she takes a group of students to Sólheim glacier where they use a steam drill, which she describes as acting like a pressure cooker—a mechanism that bores through the glacial ice like a hot knife through butter. The deep hole that is formed becomes a passage, a wire line that dips several meters into the glacier itself. As the ice on the surface melts away, the line will slowly be revealed. More line means less glacier because lost ice is now rarely replenished with an equivalent amount of new snow and ice in the ensuing winter.

Guðfinna explains that glaciers are anything but static. In fact, she says, they are best understood as operating like a conveyor belt. They move, and they move material. Snow and ice accumulate in the higher altitudes of the glacier and are depleted in the lower reaches. There is a circulation of material from high to low and from solid to liquid. Guðfinna describes glaciers in economic terms in much the same way that Helgi Björnsson, her senior colleague, does. "They are like a bank account," she explains. In the winter, positive accumulation fills up the bank. Deposits are made at higher elevations, while at lower ones, withdrawals occur. And just as you would your accounts, Guðfinna adds, "you want to keep it in a healthy balance." But we know that balance is not being achieved of late and that deposits have not kept up with expenditures.

Icelandic glaciers are especially well documented compared to many others in the world. Since the Middle Ages, and arguably over the last twelve hundred years—since the first-known human settlement of the island—Icelanders have been aware of the glaciers that occupy their homeland. Historically, the country's ice cover has varied. For Sólheim glacier, Guðfinna explains that they have excellent records going back to the 1930s. In the 1930s, temperatures had warmed and glaciers retreated. In the 1960s and 70s it became cooler and they grew. Since the mid-1990s however, they have only gone in one direction, and that is toward "ablation."

Ablation is the technical term for ice loss. In English the word denotes, in the first instance, "the surgical removal of body tissue." Coincidentally, the first person to thoroughly document Icelandic glaciers systematically was, by trade, a surgeon. In the second definition, ablation denotes the melting or evaporation of snow and ice. About half of ablation events occur through calving (cracking off of ice forms) and the other half through melting. While there have always been advances and retreats of glaciers in Iceland, Guðfinna notes that the country's glaciers have now withdrawn further than in the warm 1930s. She describes that in the West Fjords, on the

Northwestern peninsula, they are finding vegetation growth indicating newly exposed surfaces that have been ice covered for at least two to three thousand years. This is effectively "new land" now uncovered by melt.

Guðfinna and I talk for some time about what she terms "glacial response." She notes that Earth systems have accumulated only about 150 years of intensive fossil fuel use. "The atmosphere and the glaciers," she says "haven't managed to respond to it yet. Not fully. It is a slow system." And it is a very "stochastic" system—having a random probability or pattern that may be analyzed statistically but that will not be predicted precisely. "If you push it that way, you can expect a dramatic effect." But, she says,

> The climate models are not really managing to consider *all* of the physics. We have weather forecast models that are similar and they simulate the physics six or seven days into the future. This is a model that can tell you that about short-term weather, but not how the weather will be months from now. And with climate models we are really asking them to tell us what the weather will be in 100 years' time (Guðfinna pers. communication).

It is telling that Guðfinna turns to weather prediction as she speaks of glacial response. For her, and for several other glaciologists with whom I spoke, their role as scientists, they felt, was changing. Historically, glaciologists have been trained as geologists who might then specialize in cryoforms and their interactions. Glaciology, as Helgi Björnsson put it, "has always been closer to geology: observing what is happening, the forces and movements and cracks." Helgi himself began his studies and career in the "slow science" of geology. In the present, both Helgi and Guðfinna are convinced glaciology has become an exercise in understanding how ice and melt respond to larger systemic changes, including atmospheric conditions and weather. Glaciological expertise, like the cryoforms of glaciers themselves, is changing—becoming more like meteorology and attentive to the patterning of weather. If it began as a slow science, glaciology would now appear to be accelerating and observing new inputs of unprecedented weather events.

Before the Fourth Assessment Report of the IPCC, Guðfinna explained, glaciers and ice sheets often appeared in diagnostic modeling as "white mountains." Greenland and Antarctica, for example, would be represented as white, slightly protruding outlines in some past models (and in some now). But of course, ice sheets and glaciers are not inert, whitewashed, and static, but instead dynamic and contributing to sea-level rise and changing weather. Reflecting on

how glaciology was itself moving in more meteorological directions and aware that models have been insufficient, Guðfinna quite plainly stated her estimation of the present: "This is the largest uncontrolled experiment that we have ever done."

## Depressurizing

While much climate change discourse focuses on "small island nations" that appear to be sinking because of climate-induced sea level rise, Iceland is actually experiencing the inverse. It is rising out of the sea, at a rate of about 1 1/2 inches per year. As billions of tons of glacial ice melt[13] and fail to refreeze across the surface of Iceland, the earth beneath it is being depressurized and rising from its prior earthly coordinates. This is called "isostatic rebounding." Less ice on the island results in less weight creating pressure on its surface. And in a place with much geologic volatility this results in more impactful subsurface movement of magma, steam, and other pressures (Spada, Bamber, and Hurkmans 2013). An increase in volcanic eruptions, perhaps thirty times as many,[14] is expected to occur in Iceland and eruptions appear to have multiplied over the last twenty years.[15]

Compared to Antarctica and Greenland, Icelandic glaciers are more porous and have more air and water pockets. And, being located on the tectonic plate boundary of the mid-Atlantic ridge, Iceland has more glaciers atop volcanoes than anywhere else. Vatnajökull, the largest ice mass in Europe, is covering at least four active volcanoes. Because many of the country's large glaciers lie over active volcanoes[16] Iceland has installed a system of highly attuned seismometers[17] to quickly sense and respond to potential eruptions and their ensuing floods.

## For Fear of Ice

Gudni Gunnarsson and his wife Hulda Magnúsdóttir have lived their entire lives near the village of Höfn in southeast Iceland. They are sheep farmers, with a home at the foot of a glacial tongue at Fláajökull. They have an old dog and grown children and Hulda is quick to bring cakes and coffee. She has never left Höfn, literally, has never traveled further than the next two villages over. Neither Hulda nor Gudni speak English and so I rely on Hugudur, a young woman from the research center at Neimar, to translate questions and responses.

**Figure 1.2.** | *Gudni Gunnarsson pointing to Fláajökull, a glacier that borders his farm, 2016.*


Gudni is very clear that he has always found glaciers to do more harm than good. He explained in detail their dangers, the way they can crawl over land and destroy it in their wake. Glaciers could become monstrous, toppling structures and uprooting homes. More than the groaning and growing ice however, were the threats of *jökulhlaups* (glacial flooding), when melt water would pool and seep beneath the surface, causing instability at the juncture between water and ice. For a time, an ice dam might hold but it could just as easily burst without warning, sending crashing floods to all below it. This is why, Gudni explained, houses are placed higher up on the hillsides to avoid being whisked away and floated out to sea. Gudni had long understood the glacier in his backyard as an imminent threat; it was hard to live with, but you had to learn how to live with it.

Gudni had to think for a while to come up with anything positive to say about the glacier nested in the mountain near his home. Proximity is not easy. He conceded that they used to utilize the glacier for ice in the 1930s and 40s. Prior to refrigeration the glacier could provide

adequate ice to keep freshly caught fish cold. Perhaps it was doing some good in retaining water over the year for what would later become waterfalls. He remembered too teams of scientists coming to the glacier in the 1940s, but he was unclear what precisely they were looking for.

What Gudni returned to several times is that the glacier is in fact a part of the mountain, not distinct from it. It seemed that speaking about the glacier in the singular was awkward. Perhaps even illogical. Glaciers are folded into the world. After we had eaten through several dishes of cakes washed down with dark coffee Gudni did agree that he finds his glacier beautiful, but only at times.

Glaciers may have sublime beauty. But they have also been menacing, threatening life with their mass and watery outbursts. So how do we understand this ice? As ominous threat or thing of wondrous beauty? As that to be avoided, or that to which we should direct our care and concern (Latour 2004)? In contemporary discourse and media portrayals, melting cryospheres are taken as objects of apprehension and distress: a measurable, visual, mobile indicator of a climate transforming more rapidly than had been expected. But if the affective response to melting glaciers is now tilted toward alarm (and rightly so), it has not always been the case. Recognizing this ambivalence should not lead us away from the material omens that are embodied in melting ice. Rather, these prognostications of an increasingly iceless future indicate the range of possible abstractions that humans, and perhaps more importantly, the more-than-human world, can offer to climatologically troubled times (Howe 2019; Howe and Boyer 2016).

## Conclusion

In an epoch that has been dubbed the Anthropocene, human impact becomes literally set in stone, felt in the bodies of every earthly creature, and diffused through the cryosphere, hydrosphere, and atmosphere. The great melting at the top of the world, and the bottom as well, may have us wondering about what is being washed away and what future is to come.

For Sheila Jasanoff, a scholar of science and technology, "abstraction," is the key tool by which modern science cements its validity and universality. The scientific method has the capacity to abstract the phenomena it engages by lifting them out of a specific setting in order to demonstrate how fragments, elements, and pieces can be

meaningfully independent of the whole out of which they come. This is how, Jasanoff notes, science is able to achieve its epistemic value: by creating abstracted entities like the periodic table of chemical elements, the nitrogen cycle, the metric system, biodiversity, or climate change. Abstraction represents no particular person's unmediated experience (or observation) of the world and yet abstractions are often recognized and accepted as real (Jasanoff 2010: 234). In contrast to the abstraction of the scientific method outlined by Jasanoff, in this chapter I have taken a turn toward the "abstract*ive*," as a way to allow for other renderings of phenomena as "knowable" and real. If the abstraction exercised within science produces knowable fragments, taking parts from wholes and rearranging them otherwise, the practice of abstractive knowing is its opposite: a way of sensing the massive and enigmatic conditions and processes known as "climate change" in ways that are experienced at a human scale, but not necessarily felt by humans alone (Descola 2015).

The dead polar bear in Sauðárkrókur is not necessarily a sign of extinction. One killed bear does not end a species. However, the shooting of the bear and the debate surrounding her fate generated affective responses as well as critiques of existing policy. This, I would argue, is the abstractive work of the slaughtered bear: manifesting melt empirically so that it is felt. A dead bear makes climate change vividly "real" for those affected. The shot polar bear is more than a single death because it is an indicator of impending species extinctions as climate change advances and disappearing ice results in the disappearance of Arctic animals who rely on it.[18] The rebounding of Iceland itself can also be taken as an abstractive encounter, where the loss of ice across the island's surface creates the conditions for more rapid geologic upheaval. Less ice means less weight and in turn, more geological motion. Melting ice performs a reciprocal response to the activity of geos beneath it. In each of these instances, abstractive acts occur through other-than-human entities: bears and stone in response to bodies of ice. For Guðfinna, wires dropped deep into the ice indicate how layers of compacted ice are sloughed away, becoming liquid. The "mass balance" that keeps a glacier healthy, moving, and in equilibrium is no longer balanced, but tipping into deficit. For Gudni, the glacier that is slowly disappearing from behind his home may come as a relief from a natural world that in the past threatened to oust human settlement. Now, it leads to ambivalence, maybe nostalgia, and a certain unsettling. In melt, we find multiple points where abstractive encounters are assembled. Climatic conditions become known and sensed in their multiplicity. Between the

abstractive sensing that occurs with dead bears and wary farmers, and the abstractions of glaciological science, we are positioned to engage the kind of response-ability that Haraway has called for. Slipping between abstractive sensing and abstractive sciences, as melting ice would have us do, we are led to new engagements with a cryosphere disassembling, retreating, and becoming differently in its dissolve.

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## Notes

1. www.climatecentral.org/news/arctic-ice-melting-faster-18967.
2. See: www.dw.com/en/polar-ice-sheets-melting-faster-than-ever/a-16432199.
3. www.theguardian.com/environment/climate-consensus-97-per-cent/2013/nov/13/global-warming-underestimated-by-half.
4. http://www.independent.co.uk/environment/arctic-warming-twice-rate-rest-of-planet-global-warming-snow-water-ice-permafrost-arctic-monitoring-a7710701.html#http://www.independent.co.uk/environment/arctic-warming-twice-rate-rest-of-planet-global-wa.
5. By definition, glaciers are formed where winter snowfall amounts exceed that of summer melting, causing snow to accumulate on the surface and transform to ice. Critical thickness for glacier formation is approximately 30 meters with a density of 0.85 g/cm$^3$ and when these conditions are achieved, the existing ice deforms and moves downslope to become a glacier (Debarbieux 2008: 4).
6. See Katz 2013. Nearly half of the world's terrestrial glaciers are located in the Arctic region. The global total of glacialized land is 680,000 km$^2$, with 315,000 km$^2$ of that total located in the Arctic. Iceland's glaciers are considered to be especially well-documented historically (United Nations Environment Programme 2009: 52)
7. The Arctic Circle passes through Iceland's offshore island, Grímsey.
8. The Arctic Council is comprised of the following member states: Canada, Denmark/Greenland, Finland, Iceland, Norway, Russia, Sweden, and the United States, with several other countries serving as observers (China, France, Germany, India, Italy, Japan, the Netherlands, Poland, Singapore, South Korea, Spain, and the United Kingdom). Six Indigenous nations' groups—represent-

ing Aleut, Athabaskan, Gwich'in, Inuit, Saami, and Russian Indigenous Peoples—have Permanent Participant status on the Council.

9. Formerly called the Northeast Passage, the Northern Sea Route traverses the eastern Arctic seas and connects the Atlantic and Pacific oceans. The seasonal variation in the Artic is considered to be more extreme than anywhere else on earth, moving from ice-cover to lush conditions in annual cycles. The Arctic Ocean, surrounded as it is by land, is more subject to terrestrial influence than any other ocean on the planet; its hydrology is singular, on the one hand encircled by land and on the other, fed by some of the world's largest rivers (Committee on Emerging Research Questions in the Arctic, Polar Research Board 2014: vii).
10. Franz Boas's legacy is complex, including the question of how to interpret the capacity of Inuit and Yupik languages to express numerous terms for snow and ice that Boas's research documented. However, it is worth noting that the loss of Indigenous cultures in the far North, which were associated with salvage anthropology of the late nineteenth and early twentieth centuries, can be taken as the first signs of cultural "loss" due to the effects of colonial encroachment and exposure to capitalist extraction. These kinds of disappearances would continue to accelerate over time with industrial pollutants now rendering polar bears, ice, and others increasingly imperiled.
11. I thank Arthur Mason and Marcel LaFlamme for this insight on the abstractive capacity of social media.
12. https://www.theguardian.com/environment/2016/dec/19/arctic-ice-melt-already-affecting-weather-patterns-where-you-live-right-now.
13. Greenland lost a trillion tons of ice between 2011–14, resulting in twice the sea level rise compared to the prior two decades, about one centimeter each year. Antarctic and Greenland ice sheets represent 99 percent of freshwater ice on earth. By definition, an ice sheet must be at least a total of twenty thousand square miles and situated on land. If the Greenland Ice Sheet (which is about three times the size of Texas) were to melt, scientists estimate that sea levels would rise about six meters (or twenty feet). If the Antarctic Ice Sheet (which is 5.4 million square miles) were to melt entirely, sea levels would rise by about sixty meters (or two hundred feet) (Ehrlich 2015).
14. This assessment is based on the last deglaciation period beginning 12,000 years ago. Reduced pressure on rocks beneath lost ice creates more volatile molten conditions and more eruptive potential.
15. In comparison, Scandinavia was covered by an ice sheet approximately twenty thousand years ago and it continues to rebound from that time. Iceland has a thinner crust than in Scandinavia and is positioned on the plate boundary meaning there are significant differences in the rate and speed of rebounding in the two regions. One glaciologist explained rebounding movement this way: "Iceland is like a rubber band while Scandinavia is like honey."
16. When a volcano erupts, magma at temperatures as high as 2,200°F meets ice and water, which casts plumes of steam and rock particles rocketing skyward. Matthew J. Roberts, a glaciologist with the Icelandic Meteorological Office, compares the ensuing smoke and particles to a mushroom cloud.

17. http://www.nytimes.com/2006/01/17/health/science/with-glaciers-atop-volcanoes-iceland-zooms-in-on-signs-of.html.
18. While I am not making the claim that polar bears are indicator species, I am intending to evoke the idea of species and other forms (such as ice) as indicators signaling anthropogenic harm. Indicator species are unique exemplars of significant ecosystemic change, and they are an integral component of conservation biology and scientific analyses of transformed environments (and the biotic life occupying them). However, while certain biological organisms may signal ecosystemic breakdown (or recovery), they can also become contested objects of political discourses surrounding preservation measures. See for example Blaser (2016).

## References

Barnes, Jessica, Michael Dove, Myanna Lahsen, Andrew Mathews, Pamela McElwee, Roderick McIntosh, Frances Moore, Jessica O'Reilly, Ben Orlove, Rajindra Puri, Harvey Weiss, and Karina Yager. 2013. "Contribution of Anthropology to the Study of Climate Change." *Nature Climate Change* 3(June): 541–44.

Bertelsen, Rasmus Gjedssø, and Piotr Graczyk. 2016. "Establishing Shared Knowledge about Globalization in Asia and the Arctic." Hot Spots, *Cultural Anthropology* website. 29 July. Retrieved from https://culanth.org/fieldsights/934-establishing-shared-knowledge-about-globalization-in-asia-and-the-arctic.

Blaser, Mario. 2016. "Is Another Cosmopolitics Possible?" *Cultural Anthropology* 31(4): 545–70.

Boas, Franz. 1888. *The Central Eskimo.* Sixth Annual Report of the Bureau of American Ethnology for the Years 1884–1885.

Chakrabarty, Dipesh. 2009. "The Climate of History: Four Theses." *Critical Inquiry* 35(Winter): 197–221.

Crate, Susan, and Mark Nuttall. 2009. "Anthropology and Climate Change." In *Anthropology and Climate Change*, edited by Susan Crate and Mark Nuttall, 9–34. Walnut Creek: Left Coast Press, 2009.

Cruikshank, Julie. 2006. *Do Glaciers Listen? Local Knowledge, Colonial Encounters and Social Imagination*. Vancouver: UBC Press.

Debarbeiux, Bernard. 2009. Orlove, B., E. Wiegandt, and B. H. Luckman, eds. 2008. "Darkening Peaks. Glacier Retreat, Science, and Society." In *International Journal of the Commons* 3(1): 151–52. Berkeley: University of California Press.

Descola, Philippe. 2015. *Beyond Nature and Culture*. Chicago: University of Chicago.

Edwards, Paul N. 2010. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. Cambridge, MA: MIT Press.

Ehrlich, Gretel. 2015. "Rotten Ice." Retreived September 20, 2020. *Harpers*. http://harpers.org/archive/2015/04/rotten-ice/.

Grossman, Zoltan, and Alan Parker. 2012. *Asserting Native Resilience: Pacific Rim Indigenous Nations Face the Climate Crisis.* Eugene: Oregon State University Press.

Haraway, Donna J. 2015. "Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin." *Environmental Humanities* 6: 159–65.

Harwood, S., D. Carson, E. Marino, and N. McTurk. 2011. "Weather Hazards, Place and Resilience in the Remote Norths." In *Demography at the Edge: Remote Human Populations in Developed Nations*, edited by D. Carson, R. O. Rasmussen, P. Ensign, L. Huskey, and A. Taylor, 307–20. Surrey: Ashgate.

Heininen, Lassi, ed. 2015. *Future Security of the Global Arctic: State Policy, Economic Security and Climate*. London: Palgrave Pivot.

Houghton, J. T., Y. Ding, D. J. Griggs, M. Noguer, P. J. Van der Linden, X. Dai, K. Maskell, and C. A. Johnson. 2001. "Climate Change 2001: The Scientific Basis, summary for policy makers—contribution of working group I to the third assessment report of the Intergovernmental Panel on Climate Change." Retreived September 20, 2020, from https://www.ipcc.ch/report/ar3/wg1/

Howe, Cymene. 2019. *Ecologics: Wind and Power in the Anthropocene*. Durham, NC: Duke University Press.

Howe, Cymene, and Dominic Boyer. 2016. "Aeolian Extractivism and Community Wind in Southern Mexico." *Public Culture* 28(2): 215–35.

Hulme, Mike. 2011. "Reducing the Future to Climate: A Story of Climate Determinism and Reductionism." *Osiris* 26: 245–66.

Jasanoff, Sheila. 2010. "A New Climate for Society." *Theory, Culture & Society* 27(2–3): 233–53.

Jóhannesson, Ingólfur Ásgeir. 2005. "Icelandic Nationalism and the Kyoto Protocol: An Analysis of the Discourse on Global Environmental Change in Iceland." *Environmental Politics* 14(4): 495–509.

Katz, Cheryl. 2013. "What Is Iceland Without Ice?" *Scientific American*, 18 December.

Latour, Bruno. 2004. "Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern." *Critical Inquiry* 30 (Winter): 225–48.

Linnenluecke, Martina K., and Andrew Griffiths. 2015. *The Climate Resilient Organization: Adaptation and Resilience to Climate Change and Weather Extremes*. Cheltenham: Edward Elgar Publishing.

Marino, Elizabeth. 2015. *Fierce Climate, Sacred Ground: An Ethnography of Climate Change in Shishmaref, Alaska.* Fairbanks: University of Alaska Press.

Mason, Arthur. 2016. "Introduction: Assembling the Valuable and Vulnerable North." Hot Spots, *Cultural Anthropology* website. 29 July. Retrieved from https://culanth.org/fieldsights/introduction-assembling-the-valuable-and-vulnerable-north

Morton, Timothy. 2013. *Hyperobjects: Philosophy and Ecology after the End of the World*. Minneapolis: University of Minnesota Press.

National Research Council. 2014. *The Arctic in the Anthropocene: Emerging Research Questions*. Washington, DC: The National Academies Press.

Nuttall, Mark. 2009. "Living in a World of Movement: Human Resilience to Environmental Instability in Greenland." In *Anthropology and Climate Change*, edited by Susan Crate and Mark Nuttall, 292–310. Walnut Creek: Left Coast Press.

———. 2015. "Subsurface Politics: Greenlandic Discourses on Extractive Industries." In *Handbook of the Politics of the Arctic*, edited by Leif Christian Jensen and Geir Hønneland, 105–27. Northampton, MA: Edward Elgar.

———. 2016. "The Making of Resource Spaces in Greenland." Hot Spots, *Cultural Anthropology* website. 29 July. Retrieved from https://culanth.org/fieldsights/942-the-making-of-resource-spaces-in-greenland.

Parr, Joy. 2010. *Sensing Changes: Technologies, Environments, and the Everyday, 1953–2003.* Vancouver: UBC Press.

Pincus, Rebecca, and Saleem H. Ali, eds. 2015. *Diplomacy on Ice: Energy and the Environment in the Arctic and Antarctic*. New Haven: Yale University Press.

Polar Research Board. 2014. Committee on Emerging Research Questions in the Arctic. National Academy of Sciences.

Rhoades, Robert, Xavier Zapata, and Jenny Aragundy. 2008. "Mama Cotacachi: Local Perceptions and Societal Implications of Climate Change, Glacier Retreat, and Water Availability." In *Darkening Peaks*, edited by Ben Orlove, Ellen Wiegandt, and Brian H. Luckman, 218–27. Berkeley: University of California Press.

Spada, G., J. L. Bamber, and W. L. Hurkmans. 2013. "The Gravitationally Consistent Sea-Level Fingerprint of Future Terrestrial Ice Loss." *Geophysical Research Letters* 40(3): 482–86.

Strauss, Sarah, and Ben Orlove. 2003. *Weather, Climate, Culture.* Oxford, UK: Berg.

Stewart, Kathleen. 2007. *Ordinary Affects*. Durham, NC: Duke University Press.

United Nations Environment Programme. 2009. *UNEP 2008 Annual Report*. UNEP.

Watson, Donald, and Michele Adams. 2011. *Design for Flooding Architecture, Landscape, and Urban Design for Resilience to Flooding and Climate Change*. Hoboken, NJ: John Wiley & Sons.

Zolli, Andrew, and Ann Marie Healy. 2013. *Resilience: Why Things Bounce Back*. New York: Simon & Schuster.

CHAPTER 2

# The Biggest, the Best, the Most, the Last

## *Creating Valuable and Vulnerable Resources in Coastal Alaska*

Danielle Dinovelli-Lang and Karen Hébert

Talk these days about the far North is saturated with superlatives. Nowhere is this more evident than in the US state of Alaska, a place often billed as the "Last Frontier." From news coverage to activist alerts to policy briefs, all manner of media portrays this Arctic region as home to the biggest threats to the "last wild places" (NRDC 2011), on the one hand, and "unparalleled opportunities" (AAPC 2015) for prosperity and security from a new era of polar resource development on the other. These assertions of off-the-charts incomparability are often mobilized toward very different ends, such as large-scale projects for environmental protection or redoubled ambitions for resource extraction. Yet they converge in positioning Alaska as all the more at the extreme. In an earlier era, the representation of Alaska as a site of larger-than-life conditions helped establish it in the popular imagination as a proving ground for pioneering prospectors, hardy adventurers, and others seeking to shore up their own fortunes and those of the settler-colonial nation-state. Today, however, the future of life itself also seems to hang in the balance.

In a place that is increasingly imagined as harboring perils and promises at the planetary scale, how do such future projections transform the way environments are managed, inhabited, and profited

from? In this chapter, we draw upon examples from coastal Alaska involving protections over bears, otters, and fish to show how the value of abundant wild animals, and by extension other natural resources, comes to depend on the specter of catastrophic ruin. Premised on comparisons drawn through both space (e.g., the endangerment of species and ecosystems in other parts of the world) and time (e.g., a future of decline given existing threats), assessments of environmental abundance today are both dimmed and elevated by the omnipresent shadow of loss. By tracking current contestations about thriving yet imperiled animal species in the Alaskan regions where we have conducted ethnographic research, we show how recent developments amount to a noteworthy shift in the longtime composition of value, insofar as the vulnerability of natural resources to future scarcity is increasingly leveraged to emphasize their value in a global frame rather than simply borne as an unfortunate consequence or cost of use.

Neoclassical economics has long assumed that desirable natural resources are particularly vulnerable to overexploitation—which is typically then treated as a problem to be solved, whether through state regulation, for example, or the extension of private property rights. While this paradigm undoubtedly persists, our work points to another dynamic at play as well, in which vulnerability is no longer a condition to be remedied but rather a force to be harnessed, given its usefulness for actors of all sorts in heightening designations of value and opening new terrain for exploitation.

Our analysis is grounded in long-term fieldwork we have independently and collaboratively pursued on either side of Alaska's subarctic coast: Bristol Bay in southwestern Alaska and the rural communities of Sitka and Hoonah in southeastern Alaska. Bristol Bay faces threats from a controversial proposed mine, the Pebble Mine, in what has been described as one of "the last, best wild salmon ecosystems" (Wild Salmon Center 2018), while Southeast Alaska is home to polarizing debates over logging in "the world's largest remaining temperate rainforest," the seventeen-million-acre Tongass National Forest (Heacox 2019). Both regions depend heavily on commercial, recreational, and subsistence fisheries as well as nature-based forms of recreation and tourism, whose longer-term futures are darkened by climate change and ocean acidification.

In and across these sites, we explore how globally inflected assessments of risk are transforming the way such critical local resources are valued. Given Alaska's superlative status in the varied economies that hinge on interactions with the environment today, it presents a prime site for examining the tensions of what Kim Fortun (2012: 447) has

called "late industrialism," whose future is "promised and motored by neoliberalism, bolstered by digital infrastructure and wealth but still energized by coal and oil." If this condition characterizes the world at large, then Alaska now sits on its precipitous edge. Among Arctic locations, where histories of neglect and unresolved indigenous claims are only recently giving way to agreements aimed at development, Alaska, with its decades-old Alaska Native Claims Settlement Act and aging oil pipeline, stands out as a spot that may well represent a picture of things to come.

In the sections to follow, we first weave together a discussion of changing historical patterns of resource exploitation in Alaska with an analysis of several different bodies of literature on shifting resource economies to provide a theoretical framework to buttress the argument about the changing relationship between value and vulnerability that we develop through the chapter as a whole. In particular, we focus on the shifting meanings of scarcity in late industrial settings. On one level, projections of scarcity continue to rely on the calculative logics of amassment that have long been used to account for resource stocks, especially in export-oriented hinterlands like Alaska. But on another, new types of threats have become more prominent in substantiating the all-or-nothing superlatives that now hang heavy on Northern environments. Our research with scientists, activists, government officials, and rural residents highlights how these dynamics influence the management of species including bear, otter, and fish, marking, we argue, the emergence of a political economy that manages the prospect of irreparable harm to coastal economies and ecosystems not only as a limit but also as an opportunity. At the same time, the controversies over resource protections we detail below reveal this opportunity to be a double-edged sword: it opens new space for environmental-political alignments even as it tends to support forms of wealth generation that deepen administrative control over people's livelihoods for the maximization of value. We conclude by asking what it means that human futures in the Arctic are increasingly debated and even determined through the image of a vulnerable other.

## Creating Valuable and Vulnerable Resources

In recent years, Alaskan news outlets and resource management agencies have begun to buzz with concern about a novel specter lurking on the horizon as climate change alters winter conditions throughout

the North. As one Alaska Department of Fish and Game official reportedly said of the coming menace: "Now that they're moving farther north through Canada, north and west, they're eventually going to arrive here, if they're not here already. . . . We will be next. It's only a matter of time" (as quoted in Rosen 2017). The shadowy presence on the move in this case is a "ghost moose," a sickened moose whose coat has been reduced to a pale, patchy layer as its body is ravaged by a massive infestation of what are known as winter ticks. Without the help of long, cold winters to keep them in check, winter ticks can quickly expand their numbers and range, traveling literally on the backs of their moose hosts. In cases across North America, tens of thousands of ticks have been found to cling to individual moose, swelling to grape-sized nodules as they feed, weakening and often killing the larger animal (Rosen 2017). Given the prominence of moose hunting in Alaska as both a critical source of household sustenance and a lucrative sports enterprise, the predicted arrival of this new spectral species (and the tick companions that create them) has been especially chilling. Hunters are urged to be on the lookout for these ghostly apparitions, which—in the Alaskan context, where such moose have yet to be sighted—will mark the coming of a new biological, ecological, and economic era.

The figure of the ghost moose offers a gripping picture of how reckoning around the environment is changing, both in Alaska and beyond, as portents of devastation weigh on the present. While recent scholarship sensitively addresses the role of futurity in resource economies (Mason 2007, 2013; Ferry and Limbert 2008; Weszkalnys 2014; Mathews and Barnes 2016)—as well as the emergence of interspecies amalgams akin to "ghosts" and "monsters" that constitute contemporary life (Tsing et al. 2017) and the threat of mass extinction that pervades human–nature relations (Sodikoff 2012; Haraway 2016)—this work does not always consider the mechanisms by which assessments of a precarious present are themselves mobilized in the creation of value and how this process articulates with long-established resource regimes. In this section, we explore how designations of vulnerability—as exemplified by the specter of the ghost moose and other threats to species explored in the second half of the chapter—mark the rise of novel dynamics in the figuration of environmental value.

From the perspective of Alaska residents, as well as that of the hunters, anglers, and recreationalists who journey to Alaska to avail themselves of the fish and game for which the region is renowned, the state's healthy animal populations have long represented stocks of natural wealth that support robust commercial, sport, and subsis-

tence economies. Considerable scholarship examines the historical constitution of this influential mode of accounting for nature, which Sabine Höhler and Rafael Ziegler (2010: 429–30) describe as "quantifying and statistically aggregating nature into single units aiming at the calculability, comparability and visibility of uses of nature for efficiency and profitability, as well as for sustainability," practices that simultaneously relate "to the accountability of the state, of capitalist economy and of science" (see also Scott 1998; Bavington 2011; Whitney and Kiechle 2017). This work emphasizes how key elements of the ecological imagination—say, the appraisal of biotic populations by way of exhaustive monitoring and recording of their constituent members—bear the imprint of a resource-developmentalist vision. Indeed, with the biological principle of maximum sustained yield enshrined as a resource management goal in its founding Constitution, the State of Alaska came into being in 1959 at least in part to "encourage the settlement of its land and the development of its resources by making them available for maximum use consistent with the public interest" (Alaska State Government, 1956).

As these details suggest, the account of Alaskan wildlife as the stuff of a rich resource larder has a long history, which still powerfully orients policy and sentiment to this day. But it is against this backdrop that a growing view of the environment as a site of worrisome economic dependency and ecological vulnerability also first took shape. The development of Alaska through World War II and the role of Cold War security interests were especially significant in this regard. Although for much of the twentieth century Alaska was viewed as either an impenetrable wilderness or an inexhaustible storehouse of natural wealth, controversy in the late 1950s and early 1960s over a bid by the US Atomic Energy Commission to use nuclear explosions to create a deep-water port near the northwest Alaskan village of Point Hope highlighted that no place was too wild or remote to be safe from nuclear waste contamination—least of all the Arctic, where atmospheric effects, as is now known, tend to concentrate (Kirsch and Mitchell 1998). The plan for the deep-water port, known as "Project Chariot," was defeated through the grassroots organizing of concerned scientists, residents at risk, environmental advocates, and members of the public, partly on the strength of evidence that Alaskan caribou were already suffering from illnesses linked to their consumption of radioactive lichen following a decade of nuclear testing (O'Neill 2007). Often held up as an early example of environmental activism, opposition to Project Chariot can also be interpreted as an episode that embedded the threat of large-scale ecological destruction into the very idea of the environment at a

foundational moment. Indeed, as Timothy Mitchell (2011: 192) argues, "the environment" is not an external reality at all but rather a concrescence of calculations based partly on the permanence of nuclear harm, and against which the seemingly more manageable harms of oil and gas production could be profitably measured (see also Masco 2010).

Nevertheless, the omnipresence of possible disaster was soon extended to the fossil fuel industry itself following the 1989 *Exxon Valdez* oil spill. In the blink of an eye this catastrophe smothered the bountiful and stunningly beautiful Prince William Sound with a seeping layer of toxic crude oil, and it transformed the State of Alaska from "a treasure house of natural resources" (Hamer 1976) into a victim of an environmental disaster. The vastness of its oil wealth suddenly became a threat in equal measure to its promise as Alaskans woke up to their own oil dependence recast as ecological and economic vulnerability. At the same time, the State's efforts to receive compensation for the loss of environmental value due to the spill became part of a global transformation in the evaluation of nature associated with the rise of neoliberalism (Nelson 2017). Indeed, according to geographer Sara H. Nelson (2017: 120), the spill, and especially its aftermath, still "permeates a contemporary economy characterized by new metrics to rationalize environmental values, new corporate–NGO partnerships to capitalize on these values, and the increasingly financialized forms of their circulation." Like Project Chariot before it, the *Exxon Valdez* oil spill represents a key moment in the constitution of the environment as a source of value ultimately measurable in the face of its catastrophic annihilation.

More importantly for our argument here, Nelson (2017: 121) pinpoints the *Exxon Valdez* spill as a crucial event in "redefining the notion of value itself and the terms on which it operated in public policy." In this case, neoliberal economists' efforts to make environmental "bads" and economic "goods" comparable with respect to a singular measure of value were thrown into unexpectedly dramatic relief as the calculable costs of the spill threatened to climb beyond the limits not just of Exxon's ability to pay, but also of the oil industry's ability to continue to demonstrate that the economic benefits of fossil fuel development outweighed its risks (Nelson 2017: 124–25; see also Mitchell 2011; Beck 2015). Taking Mitchell's argument about the role of expert calculations in consolidating the idea of the environment a step further, Nelson (2017: 120) urges scholars to consider how the valuation of nature has become an exercise foundational to the reproduction of emergent modes of governance. We take up this charge in the sections to come, which show how struggles over natu-

ral resources in Alaska today are centered on and saturated with the specter of loss. In describing contests over the management of bear, otter, and fish, respectively, we show how one model of valuation premised on a certain kind of additive calculability is being disrupted by the permanent shadow of catastrophic risk—and often in ways that expand rather than restrict the value attributed to these resources. Our research further finds that this takes place in close step with tightening constraints on local resource access, uses, and practices. At first glance it may seem improbable that the mere prospect of future harm would have such an immediate and concrete effect. But as Brian Massumi (2010: 80) observes, this kind of threat is always real, and not "in spite of its nonexistence. It is superlatively real, because of it. . . . The future of threat is forever."

## Abundant Brown Bears and the Powers of Preemption

In Alaska today, brown bear (*Ursus arctos*, a species that includes grizzlies) populations are healthy, stable, and in some cases even on the rise (Miller 1993; McLellan et al. 2017). Like the other valuable species whose interrelationships with humans we examine, this abundance sets Alaska's resident brown bears apart: the animals are endangered in most of the other regions in which they are currently found and have been extirpated from large swaths of their onetime habitat (McLellan et al. 2017). Yet the comparative flourishing of brown bears in Alaska has intensified, rather than quelled, concerns about their future. As state officials note: "Alaska has over 98 percent of the United States population of brown bears, and more than 70 percent of the North American population, so it has a special responsibility to this magnificent animal" (ADFG 2021). In particular, the bears' high numbers are seen to put them at risk of being targeted for unusually destructive forms of predation, like poaching. From the perspective of state resource managers, Alaska's brown bears are menaced by a host of existential threats that render them "worth more dead than alive," as some officials have put it (see Vines 1992). Such hyperbolic comparisons between the specter of market-driven poaching, on the one hand, and state-regulated enterprises such as sport hunting and bear viewing, on the other, help reinforce the idea that it is revenue-minded state resource managerialism that guarantees the animals' steady and ongoing production and reproduction.

In the name of preempting possible future poaching of brown bears in Alaska, the state has enacted a series of laws and regulations that

limit or negate the value rural Alaskan residents can recover from the bears in their midst. For example, the hides of bears killed in what the law terms "defense of life or property" are seized and auctioned off in support of state wildlife management efforts, while subsistence hunters harvesting bear are asked to forego profits from the sale of bear claws, which might otherwise encourage them to undertake the risk and expense of hunting bear commercially (Federal Subsistence Board 2012: 174–89). And yet, in Alaska's Interior, where interest in moose hunting dominates, the State of Alaska operates several "predator control" programs that involve baiting and trapping bears and cubs, keeping bear populations in check for the intended benefit of an even more valuable and vulnerable quarry. Taken together, these interventions suggest that the vulnerability of bears to poaching, like the vulnerability of moose to bears, is as much a tool for linking the value of a resource to state managers' knowledge and authority for the foreseeable future—"forever," in Massumi's terms—as it is a problem demanding managerial intervention.

The state's efforts to ratchet up brown bear protections, which impinge on everyday practices of local residents, are intended to close off the various loopholes and openings imagined to permeate the categories by which bear populations are currently governed and monitored. Looming large here is the acquisitive juggernaut of state-capitalist China, with what one prominent bear biologist calls its "1.2 billion potential or actual users of traditional Chinese medicine" (Servheen 1999: 37), including the pluripotent gastric juices found in wild bears' gallbladders (see Y. Li et al. 1995). This projection of exponentially increasing demand is grounded in the problematic if not racist calculation that all Chinese people are consumers of bear gall, as well as the similarly unsubstantiated supposition that their voracious appetite would be whetted by the allure of untapped reserves of Alaskan bear stocks in light of depleted Asian populations (Servheen 1999: 37–38). Equally crucial to this implicit threat is the figure of the opportunistic poacher and bear parts trader hiding within the borders of the nation-state, who will inevitably arrive on the scene to exploit "the disparity in demand and price for bear parts between North America and Asia" (Servheen 1999: 36).

The preemption of the poacher is consequential here. As the above examples suggest, anticipatory action by Alaskan officials in advance of potential brown bear poaching authorizes the state's assertion of control over rural livelihoods and the multispecies relations these encompass. Moreover, such responses reveal the logics that underpin the twin resource economies of sports hunting and conservation that

have long held sway in rural Alaska, while at the same time throwing into relief precisely how these are challenged by anxieties of large-scale ecological breakdown. Yet this assumption of constant threat does not merely enhance the bears' value and authorize state intervention to secure it; it also yields new challenges for the orderly management of Alaska's bears. A dramatic example of this occurred when the animal rights activist Timothy Treadwell set up his fateful camp in Katmai National Park, in southwestern Alaska. Treadwell claimed that his occupation was necessary to protect the bears from hordes of ruthless and conniving poachers, to whom, he claimed, the park administration had turned a blind eye (Jans 2006). Despite the absence of any sign of poaching in the park, Treadwell was able to fund thirteen seasons of remote wilderness camping trips with the support of donors who believed the poaching threat to be real. Treadwell's story became sensational following his and his partner's violent deaths in a bear attack in 2003 (see Herzog 2005). But it is arguably his years of occupation of the so-called Grizzly Maze that is the more extraordinary occurrence, insofar as his purported protection of unthreatened (and mostly, until the end, unthreatening) bears was motivated, justified, and underwritten by the shadow of potential future threat. Despite the extraordinary specifics of Treadwell's case, the structure of vulnerability it reveals applies to a much wider range of situations and species in Alaska and beyond.

## Proliferating Otters and the Exertion of Market Control

Until recently, the story of the sea otter in Alaska was, like the bison of the western US plains, another classic tale of the overexploitation of a resource due to the short-sighted greed of hunters and a lack of scientific knowledge of population dynamics, such that individual hunters did not realize the consequences of their collective action on the species as a whole until it was too late. In both cases, each species' normally adaptive tendency to gather in large groups—and to amalgamate smaller groups into larger groups—meant that hunters never encountered few bison or sea otters, but rather fewer and fewer multitudes as overhunted populations consolidated into the largest and most genetically diverse groups they could muster. In both cases market conditions worsened the situation, as hunters strove to maintain a competitive edge through the wholesale slaughter of the rafts or herds they encountered. In conservationist narratives about both cases, importantly, this hunting for the market is positioned in contrast to the

subsistence hunting of precolonial Native tribes that preceded it as well as the superior value to be realized from the science-based conservation that was to come, reinforcing a narrative of scientific progress borne out of the inevitability of market rule (e.g., McLeish 2018).

While this overall narrative persists in twenty-first-century Alaska, the sea otters' story has taken an unexpected turn given that the small group of sea otters reintroduced to Southeast Alaskan waters in the 1960s has since increased its numbers to historically unprecedented levels. Now it is the otters themselves, rather than their hunters, who as often as not are cast in media reports, as well as in the everyday conversation of many Southeast Alaskans, in the role of the rapacious top predator, outcompeting all others for a dwindling food supply without a thought for others' livelihoods or for their own ecological future (e.g., Mader 1993; Klouda 2013). The region's once lucrative dive fisheries for sea urchin and abalone have all but disappeared, and even the common Dungeness crab is starting to be in short supply (Soley 2015). Whether or not the otters are the only culprit, they are the most visible and definitely the most polarizing. Enmity toward the supposedly overpopulated sea otters can almost stand as a marker separating a real Alaskan from an "outside" conservationist—an old antagonism not softened by the common presence of sea otter faces on the promotional materials of internationally funded conservation organizations such as the Monterey Bay Aquarium or Defenders of Wildlife.

Caught in the middle of this classic struggle over forms of endangerment (Choy 2011)—between rural livelihoods and keystone species, in this case—are those charged with restoring balance to Southeast Alaska's economic and biotic ecosystem (Dinovelli-Lang 2017). Thanks to a key provision in the Marine Mammal Protection Act of 1972 (MMPA), these are coastal resident Alaska Natives who are allowed to hunt sea otters for traditional uses under the watchful eye of the US Fish and Wildlife Service. As a number of those subjected to it insisted to us, this eye is very, very watchful even in comparison to other hunts authorized under the MMPA, thanks to conservationist worries about the reemergence of an Asian market for sea otter pelts. A 1993 news story about the otters' rebound stoking fears of renewed overexploitation focused on an Alaska Native-owned company's marketing brochure, found in Japan, which suggested the use of sea otter penises as aphrodisiacs (Mader 1993). Since the Fish and Wildlife jurisdiction does not extend overseas, managers have focused their attention on containing the profitability of sea otter fur products sold by Alaska Natives at home. Ostensibly protective both

of otters and of Native traditions, the sale of whole pelts is banned, as is the development of any "significant commercial enterprise," and the required "significant alteration" of sea otter fur products is limited to hand-sewn decorations consistent with characteristically Native design motifs (USFWS n.d.). Implicit in these interventions is not only the premise of an insatiable demand for sea otter products but also the anticipated inability of Native hunters to sustainably harvest the otter were a market to be legalized. Just as the otters are viewed as permanently vulnerable to overhunting, Alaska Natives are considered permanently vulnerable to corruption by the overwhelming force of the market. And while this implies that the market and the otters either cannot or must not be controlled, Native traditions still need the guiding hand of the state to protect them from themselves.

A key irony here is that Alaska has a particularly excellent track record of exerting this sort of control over markets and the wild resources circulating in them—that is, of successfully managing its fish and game for maximum sustained yield consistent with its constitutional mandate. There are certainly marked inequities in Alaska's wildlife management regime, as it often fails to do this for the "benefit of all Alaskans," another core constitutional directive (Alaska State Government, 1956). This is especially evident in contentious struggles over mechanisms to limit fishing effort, given that prices of fishing permits and quotas have ballooned well out of the reach of many rural Alaskans (Langdon 1989; Carothers 2010; Carothers and Chambers 2012; Loring 2013; Hébert 2014; Donkersloot and Carothers 2016). Yet such controversies speak to debates over *how* state and federal governments might best use their regulatory authority to influence markets rather than their perceived inability to regulate "the" market at all. In fact, the presence of otters in Alaska today is a direct result of earlier state efforts at market intervention. The forebears of the otters that abound at present in Southeast Alaska were transplanted in the 1960s, well before the institution of the MMPA, by Alaska's governor Wally Hickel, in hopes that the population would grow large enough to sustain a lucrative and well-regulated market in their furs (Connelly 1967).

The oft-lauded conservation success story of Alaskan resource management across species thus begs questions about what form of power is engendered through the conjuring of an uncontrollable market in some cases and not others. In the case of Southeast Alaskan otters, the specter of extinction that paradoxically menaces thriving populations recalls what some scholars have described as "green grabbing," whereby internationally mandated protections for valuable

and vulnerable species turn out to entail a massive transfer of wealth from long-established, localized resource-dependent communities to extra-local constituencies through the extension of a definitively global regime of value (Fairhead, Leach, and Scoones 2012; see also West, Igoe, and Brockington 2006; T. Li 2011). Here, we underline the way in which even without the outright privatization of communal land holdings, a globalized sense of peril becomes necessary to maintain the value of, say, an eco-tour of endangered otters in Alaska, even as Native and non-Native Alaskans struggle to make a living from the same well-managed environment.

## Strong Salmon Runs and Threats to Life Itself

Perhaps more than any other Alaska wildlife, the salmon has come to serve as an emblem of the untrammeled abundance that distinguishes Alaskan ecologies. State waters are home to some of the world's strongest salmon runs, setting Alaska apart from many other stretches of the North Pacific where salmon populations are threatened, endangered, and even extinct (Augerot and Foley 2005). In part for this reason, salmon have emerged in recent years across coastal regions not merely as a symbol of ecological vitality but more pointedly as a poster child for the vulnerability of Alaskan communities to resource development initiatives and the environmental impacts predicted to accompany them. Whether in the context of threats to ecosystems in Southeast Alaska from ongoing intensive logging in the Tongass or to the waters and lands of southwestern Alaska from the potential of massive mineral development in the form of the proposed Pebble Mine in Bristol Bay, social movements opposed to destructive development prospects have coalesced under the banner of salmon to fight for more sustainable rural futures.

With names like Stand for Salmon and The Salmon Project, a number of campaigns seek to celebrate and/or strengthen existing salmon management regimes as a bulwark against controversial extractive projects. For instance, the Stand for Salmon initiative has aimed to introduce additional language into state law to specify how agencies overseeing development efforts should define healthy salmon habitat, demarcate jurisdiction, and determine the amount of permissible damage to waterways. While the campaign is most readily associated with a state ballot initiative that was voted down by Alaskans in 2018 after considerable media blitzing from both sides, particularly extractive industry players mobilizing in opposition, its underlying

goals are still heralded as a future vision to fight for (e.g., Jones 2018). According to the organization, the effort is a response to loosen existing guidance by pinpointing "what it means to 'develop responsibly' in salmon habitat" (Stand for Salmon n.d.), given that there is no concrete definition on the books. It is also said to reflect the practical challenges stemming from the current system for determining salmon habitat, which requires the exhaustive investigation and documentation of individual waterways to prove that salmon are present, even for bodies of water widely acknowledged to contain salmon (see Hébert and Brock 2017 on this imperative to formally register "anadromous waters"). By delineating the proper protection of fish and game and presuming that fish habitat exists across all waterways in the salmon-rich state, the Stand for Salmon campaign has foregrounded the prospect of definite harm from resource development activity to even potential salmon populations. This move, while undoubtedly reasonable for managing extractive projects in sensitive ecological zones, has the effect of extending similar conditions in space to those that increasingly characterize threats to salmon in time. In short, the vulnerability of salmon now stretches across both. Whereas calculative logics of resource amassment are premised on ideas of fungibility—that shortfalls in one season or region might be made up for by gains in another, for instance—current campaigns on behalf of salmon reflect an emergent perspective that underscores the prospect of total ecological annihilation from which there is no return and for which there is no adequate form of insurance or intervention. As the proliferation of salmon-centered campaigns across coastal Alaska suggests, salmon has become even more valuable in both affective and market terms as a result.

Elsewhere, we have explored the unanticipated openings generated by this possibility: namely, the powerful new sociopolitical alliances and multispecies alignments that are taking shape in the face of imperilment (Dinovelli-Lang with Hébert 2015; Hébert with Dinovelli-Lang 2016; Hébert 2016; Hébert and Brock 2017). Indeed, in the case of the Pebble Mine, mobilizations to protect Bristol Bay salmon have helped to flip the script on mining development from economically necessary to economically disastrous for fishery-dependent livelihoods. But it is also critical to note how these strategies enjoin people to envision (and advocate for) human futures through vulnerability, and particularly that of another species. For example, messaging from The Salmon Project (2016) reminds Alaskans to "Declare Your Life a Salmon Life" and so push to protect salmon. In the face of threats to life itself, such new imperatives emphasize the worth of an economi-

cally important species as a means of ensuring ongoing human existence: "The Alaskan life is a salmon life, worth living and protecting" (Salmon Project 2016). While these injunctions involving salmon are distinct from the kinds of managerial pressures exerted by the state in the case of bears and otters, they nevertheless forge a compulsory attachment to imperilment that is enacted as an imperative of both stewardship and market productivity. Whereas economic prosperity once authorized the large-scale extraction of Northern resources, the specter of ecological catastrophe now compels the revaluation of life itself as a threatened resource in need of protection not *from* but *for* exploitation.

## Conclusion

The people living along Alaska's coasts have long fashioned livelihoods through a sometimes uneasy negotiation of the multiple natures that have been projected onto the circumpolar North. Its identities as a nearly inexhaustible storehouse of valuable natural resources and a critically vulnerable, pristine sanctuary have been especially consequential. Yet, as we have outlined in this chapter, the relationship between these historically opposed environmental visions appears to be changing as invocations of imperilment are generating new reserves for the creation of economic wealth. These dynamics are provoking a range of novel effects, fueling new social movements and spurring significant victories in contentious environmental struggles. But along with these otherwise positive results, they are nevertheless tethering rural communities to forms of governance that intervene in everyday ways of making a living from the ecologies that have always sustained coastal residents. These interventions enforce linkages between local livelihoods and global environmental values that enjoin rural people and animals to play the role of a "dying breed" in order to attract outside investment (see Hébert 2015)—now due less to a sense of inevitable progress, as in the past, and more to a sense of inevitable decline. Resilience in the face of this inevitability is the best that these new environmental subjects can hope for, since the prospect of changing the world order that makes them appear as victims regardless of their circumstances is unthinkable in what are still best understood as colonial contexts throughout the North (Cameron 2012).

In continuing to market Alaska as a place that still has, at least for the time being, what others have lost, the conservationist projects we have described ironically point to exactly what is really unsustainable

about present conditions: namely, gross inequality, which ensures ongoing disparities in access to environmental goods. This suggests that certain threats remain motivating—such as the fear of the power of an uncontrollable market, which is used to justify a variety of restrictions on local resource users—because they may represent a politically acceptable way to articulate underlying anxieties about the power of the dispossessed. While we do not mean to diminish efforts to show how fundamentally global phenomena like climate change differentially affect the most marginalized communities, we wonder whether the globalization of "the environment" in political discourse (Mitchell 2011; see also Ingold 2000) that has made such observations possible has also made it harder to see how the value of natural resources is always linked to dispossession (Marx [1867] 1976; see also Coulthard 2014). After all, natures become measurable as resources and environments become quantified as values only to the degree that they are not, foremost, anyone's habitats and homes. Against this, we suggest that the historical significance and future promise of coastal Alaskan environmental politics lies in rural residents' long experience of managing newcomers' often capricious interest in their forms of wealth and ways of life.

Instead of taking for granted that Northern communities are sandwiched between an uncontrollable market and an unpredictable nature—and thus in constant peril of being swallowed up by the sheer scale of each—it would be better to investigate the ways in which "nature" and "market" are continually recalibrated to explain the necessity of state, corporate, and NGO manipulations of rural livelihoods. This might lead us to see the problem posed by the burgeoning sea otter population in Southeast Alaska, for example, as a struggle between Fish and Wildlife managers and Alaska Native sea otter hunters and fur-sewers over the working conditions of the production of a conservation success story, rather than as an impossible choice between preserving local fisheries and saving the world's sea otters. We might then ask how and why certain communities become responsible for both nature and the market as producers, and what the politics of their liberation might entail.

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## References

Alaska Arctic Policy Commission (AAPC). 2015. "Final Report of the Alaska Arctic Policy Commission." Retrieved 27 May 2021 from https://uaf.edu/caps/resources/state-of-alaska-policy-documents/aapc-final-report-2015.pdf.

Alaska Department of Fish and Game (ADFG). 2021. "Brown Bear (*Ursus arctos*)." Retrieved 27 May 2021 from http://www.adfg.alaska.gov/index.cfm?adfg=brownbear.printerfriendly.

Alaska State Government. 1956. "The Constitution of the State of Alaska." Retrieved 31 January 2022 from https://ltgov.alaska.gov/information/alaskas-constitution.

Augerot, Xanthippe, and Dana Nadel Foley. 2005. *Atlas of Pacific Salmon: The First Map-Based Status Assessment of Salmon in the North Pacific*. Berkeley: University of California Press.

Bavington, Dean. 2011. *Managed Annihilation: An Unnatural History of the Newfoundland Cod Collapse*. Vancouver: UBC Press.

Beck, Ulrich. 2015. "Emancipatory catastrophism: What does it mean to climate change and risk society?" *Current Sociology* 63(1): 75-88.

Cameron, Emilie S. 2012. "Securing Indigenous Politics: A Critique of the Vulnerability and Adaptation Approach to the Human Dimensions of Climate Change in the Canadian Arctic." *Global Environmental Change* 22(1): 103–14.

Carothers, Courtney. 2010. "Tragedy of Commodification: Transitions in Alutiiq Fishing Communities in the Gulf of Alaska." *MAST* 90(2): 95–120.

Carothers, Courtney, and Catherine Chambers. 2012. "Fisheries Privatization and the Remaking of Fishery Systems." *Environment and Society* 3: 39–59.

Choy, Timothy. 2011. *Ecologies of Comparison: An Ethnography of Endangerment in Hong Kong*. Durham, NC: Duke University Press.

Connelly, Dolly. 1967. "A Brand-New Horror for Harried Husbands." *Sports Illustrated*, 27 November. Retrieved 27 May 2021 from https://www.si.com/vault/1967/11/27/609766/a-brandnew-horror-for-harried-husbands.

Coulthard, Glen Sean. 2014. *Red Skin, White Masks: Rejecting the Colonial Politics of Recognition*. Minneapolis: University of Minnesota Press.

Dinovelli-Lang, Danielle. 2017. "The Other Otter: Relational Being at the Edge of Empire." In *Anthropology and Alterity: Responding to the Other*, edited by Bernhard Leistle, 107–23. New York: Routledge.

Dinovelli-Lang, Danielle, with Karen Hébert. 2015. "Working With." *Envirosociety*, 15 April. Retrieved 27 May 2021 from http://www.envirosociety.org/2015/04/working-with.

Donkersloot, Rachel, and Courtney Carothers. 2016. "The Graying of the Alaskan Fishing Fleet." *Environment* 58(3): 30–42.

Fairhead, James, Melissa Leach, and Ian Scoones. 2012. "Green Grabbing: A New Appropriation of Nature?" *Journal of Peasant Studies* 39(2): 237–61.

Federal Subsistence Board. 2012. Wildlife Meeting Materials, 17–20 January 2012. Retrieved 27 May 2021 from https://www.doi.gov/sites/doi.gov/files/uploads/FSB%20Meeting%20Book%20Jan%202012%20-%20Final.pdf.

Ferry, Elizabeth Emma, and Mandana E. Limbert, eds. 2008. *Timely Assets: The Politics of Resources and Their Temporalities*. Santa Fe: School for Advanced Research Press.

Fortun, Kim. 2012. "Ethnography in Late Industrialism." *Cultural Anthropology* 27(3): 446–64.

Hamer, John. 1976. "Alaskan Development." *Editorial Research Reports* 2(23): 929–50.

Haraway, Donna J. 2016. *Staying with the Trouble*: *Making Kin in the Chthulucene*. Durham, NC: Duke University Press.

Heacox, Kim. 2019. "Let It Be: Why We Must Save Alaska's Pristine Tongass Forest." *Yale Environment 360*, 17 December. Retrieved 31 May 2021 from https://e360.yale.edu/features/let-it-be-why-we-must-save-alaskas-pristine-tongass-forest.

Hébert, Karen. 2014. "The Matter of Market Devices: Economic Transformation in a Southwest Alaskan Salmon Fishery." *Geoforum* 53: 21–30.

———. 2015. "Enduring Capitalism: Instability, Precariousness, and Cycles of Change in an Alaskan Salmon Fishery." *American Anthropologist* 117(1): 32–46.

———. 2016. "Chronicle of a Disaster Foretold: Scientific Risk Assessment, Public Participation, and the Politics of Imperilment in Bristol Bay, Alaska." *Journal of the Royal Anthropological Institute* 22(S1): 108–26.

Hébert, Karen, and Samara Brock. 2017. "Counting and Counter-Mapping: Contests over the Making of a Mining District in Bristol Bay, Alaska." *Science as Culture* 26(1): 56–87.

Hébert, Karen, with Danielle Dinovelli-Lang. 2016. "Working With, Part Two: On the Work of Collaboration in Coastal Alaska." *Envirosociety*, 10 Febru-

ary. Retrieved 27 May 2021 from http://www.envirosociety.org/2016/02/working-with-part-ii-on-the-work-of-collaboration-in-coastal-alaska.
Herzog, Werner, dir. 2005. *Grizzly Man*. 103 min. Santa Monica, CA: Lions Gate.
Höhler, Sabine, and Rafael Ziegler. 2010. "Nature's Accountability: Stocks and Stories." *Science as Culture* 19(4): 417–30.
Ingold, Tim. 2000. *The Perception of the Environment: Essays on Livelihood, Dwelling, and Skill*. London: Routledge.
Jans, Nick. 2006. *The Grizzly Maze: Timothy Treadwell's Fateful Obsession with Alaskan Bears*. New York: Plume.
Jones, Brendan. 2018. "We Need Salmon in Alaska and the Pacific Northwest, and They Need Our Protection." *Seattle Times*, 14 December. Retrieved 28 May 2021 from https://www.seattletimes.com/opinion/we-need-salmon-in-alaska-and-the-pacific-northwest-and-they-need-our-protection/.
Kirsch, Scott, and Don Mitchell. 1998. "Earth-Moving as the 'Measure of Man': Edward Teller, Geographical Engineering, and the Matter of Progress." *Social Text* 54: 100–34.
Klouda, Naomi. 2013. "A Bounty on Sea Otters?" *Homer Tribune*, 15 March. Retrieved 27 May 2021 from https://www.adn.com/alaska-news/article/bounty-sea-otters-bill-proposes-100-otter/2013/03/16.
Langdon, Steve J. 1989. "From Communal Property to Common Property of Limited Entry: Historical Ironies in the Management of Southeast Alaska Salmon." In *A Sea of Small Boats*, edited by John Cordell, 304–32. Cambridge, MA: Cultural Survival.
Li, Tania Murray. 2011. "Centering Labor in the Land Grab Debate." *Journal of Peasant Studies* 38(2): 281–98.
Li, Ya-Wei, Xiu-Yuan Zhu, Paul Pui-Hay But, and Hin-Wing Yeung. 1995. "Ethnopharmacology of Bear Gall Bladder." *Journal of Ethnopharmacology* 47(1): 27–31.
Loring, Philip A. 2013. "Alternative Perspectives on the Sustainability of Alaska's Commercial Fisheries." *Conservation Biology* 27(1): 55–63.
Mader, Ian. 1993. "Sea Otter Population Booms amid Hunting Ban." *Los Angeles Times*, 25 July. Retrieved 27 May 2021 from https://www.latimes.com/archives/la-xpm-1993-07-25-me-16689-story.html.
Marx, Karl. (1867) 1976. *Capital: A Critique of Political Economy*, Volume 1. Translated by Ben Fowkes. New York: Penguin.
Masco, Joseph. 2010. "Bad Weather: On Planetary Crisis." *Social Studies of Science* 40(1): 7–40.
Mason, Arthur. 2007. "The Rise of Consultant Forecasting in Liberalized Natural Gas Markets." *Public Culture* 19(2): 367–79.
———. 2013. "Forms of Time in Alaska Natural Gas Development." *Polar Record* 49(1): 42–49.
Massumi, Brian. 2010. "The Future Birth of the Affective Fact: The Political Ontology of Threat." In *Digital and Other Virtualities*, edited by Antony Bryant and Griselda Pollock, 79–92. London: I. B. Tauris.
Mathews, Andrew S., and Jessica Barnes. 2016. "Prognosis: Visions of Environmental Futures." *Journal of the Royal Anthropological Institute 22*(S1): 9–26.
McLeish, Todd. 2018. *Return of the Sea Otter: The Story of the Animal that Evaded Extinction on the Pacific Coast*. Seattle: Sasquatch Books.

McLellan, B. N., M. F. Proctor, D. Huber, and S. Michel. 2017. "*Ursus arctos*." *IUCN Red List of Threatened Species*. Retrieved 27 May 2021 from https://doi.org/10.2305/IUCN.UK.2017-3.RLTS.T41688A121229971.en.

Miller, Sterling D. 1993. "Brown Bears in Alaska: A Statewide Management Overview." Wildlife Technical Bulletin, no. 11. Juneau: Alaska Department of Fish and Game, Division of Wildlife Conservation.

Mitchell, Timothy. 2011. *Carbon Democracy Political Power in the Age of Oil*. New York: Verso.

Natural Resources Defense Council (NRDC). 2011. "Protecting Bristol Bay: Saving America's Last Wild Places." Fact sheet, 3 June. Retrieved 27 May 2021 from https://www.nrdc.org/resources/protecting-bristol-bay-saving-americas-last-wild-places.

Nelson, Sara H. 2017. "Containing Environmentalism: Risk, Rationality, and Value in the Wake of the Exxon Valdez." *Capitalism Nature Socialism* 28(1): 118–36.

O'Neill, Dan. 2007. *The Firecracker Boys: H-Bombs, Inupiat Eskimos, and the Roots of the Environmental Movement*. New York: Basic Books. Originally published in 1994.

Rosen, Yereth. 2017. "Threat of Moose-Killing Tick Infestation Looms as Far-North Climate Warms." *Anchorage Daily News*, 2 December. Retrieved 27 May 2021 from https://www.adn.com/alaska-news/environment/2017/05/06/threat-of-moose-killing-tick-infestation-looms-as-far-north-climate-warms.

Salmon Project. 2016. "Salmon Life: A Life Worth Living." Video, 31 January. Retrieved 27 May 2021 from https://www.facebook.com/aksalmonproject/videos/1106862739348558.

Scott, James C. 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven: Yale University Press.

Servheen, Christopher. 1999. "The Trade in Bears and Bear Parts." In *Bears: Status Survey and Conservation Action Plan*, compiled by Christopher Servheen, Stephen Herrero, and Bernard Peyton, 33–38. Gland, Switzerland: International Union for the Conservation of Nature. Retrieved 27 May 2021 from https://portals.iucn.org/library/node/7503.

Sodikoff, Genese Marie, ed. 2012. *The Anthropology of Extinction: Essays on Culture and Species Death*. Bloomington: Indiana University Press.

Soley, Teresa. 2015. "Dive Fishermen and Sea Otters Face Complex Competition." *Alaska Public Media*, 3 December. Retrieved 27 May 2021 from https://www.alaskapublic.org/2015/12/03/dive-fishermen-and-sea-otters-face-complex-competition.

Stand for Salmon. n.d. Stand for Salmon website. Retrieved 3 March 2018 from http://www.standforsalmon.org.

Tsing, Anna Lowenhaupt, Heather Anne Swanson, Elaine Gan, and Nils Bubandt, eds. 2017. *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene*. Minneapolis: University of Minnesota Press.

US Fish and Wildlife Service (USFWS). n.d. "Alaska Sea Otter Hunting and Handicrafting." Retrieved 3 March 2018 from https://www.fws.gov/alaska/pages/marine-mammals/alaska-sea-otter-hunting-handicrafting.

Vines, Gail. 1992. "Bears 'Worth More Dead than Alive.'" *New Scientist*, 29 February. Retrieved 27 May 2021 from https://www.newscientist.com/article/mg13318101-900-bears-worth-more-dead-than-alive.

West, Paige, James Igoe, and Dan Brockington. 2006. "Parks and Peoples: The Social Impact of Protected Areas." *Annual Review of Anthropology* 35: 251–77.

Weszkalnys, Gisa. 2014. "Anticipating Oil: The Temporal Politics of a Disaster Yet to Come." *Sociological Review* 62(S1): 211–35.

Whitney, Kristoffer, and Melanie A. Kiechle. 2017. "Introduction: Counting on Nature." *Science as Culture* 26(1): 1–10.

Wild Salmon Center. 2018. "Wild Salmon Center." Retrieved 4 January 2018. https://www.instagram.com/wildsalmoncenter/?hl=en.

CHAPTER 3

# Timescaping the Arctic with Real-Time Data

## *Challenges for Fishing and Oil Interests*

Vidar Hepsø and Elena Parmiggiani

Environmental monitoring in Norway aims to assess whether the environmental status of the Norwegian continental shelf (NCS) is stable or deteriorating due to petroleum extraction. Regulations issued by the Norwegian government have defined requirements to assess the environmental status of the water column and the seabed on the NCS. These assessments, conducted through offshore surveys, should document whether and to what extent organisms in Norwegian waters are affected by pollution generated by oil and gas activities, including produced water discharges, chemical additives, and seeps or leaks from the seabed.

There are many stakeholders in this domain, and, in this chapter, we have simplified them to four main groups that are somewhat unique to Norway (see also Olsen et al. 2016). First, the oil and gas industry: for these actors, environmental monitoring is part of their risk-based environmental management strategy. To comply with regulations the oil companies need tools and methods to evaluate risks, set up cost-benefit analyses, and prioritize scarce resources. They are obliged to differentiate natural variation from the local impact of petroleum-related activities, as well as to provide early warning for undesired environmental impacts. Such capabilities build on standards, infrastructure, and practices that already exist in more southerly extraction zones.

A second player is the commercial fishing interests, which have shared the same territory with the oil and gas industry for four decades. Fishermen are concerned that a further expansion of oil and gas traffic on the NCS might irreversibly degrade fish populations. A third important stakeholder on the NCS is the community of research institutions, like the Institute for Marine Research (IMR), which have extensive and publicly recognized knowledge of marine biology and which are concerned about the possible impact of further development (Blanchard et al. 2014; Hauge et al. 2014). Several environmental protection NGOs are also aligned with these research institutions.

The Norwegian authorities, the final stakeholder, must strike a balance between their various commitments. Thus, a portion of oil and gas revenues is invested by the authorities to support the fishery sector; today, Norway is the third largest fish exporter in the world. Even though the authorities have a strong environmental mandate to decrease emissions of $CO_2$, the state has also established the world's largest pension fund with the revenues and taxes generated by oil and gas activities. To compensate for eventual drops in production and income, the authorities regularly consider opening new areas in the Norwegian Arctic for petroleum activities. In 2013 the Norwegian parliament halted further development of petroleum resources in the Lofoten Vesterålen area, just above the Arctic Circle. But in 2016 and 2017, there were several drilling campaigns with successful discoveries in the Barents Sea. The authorities use risk assessments to determine whether a risk is acceptable to society, to address public concerns, and to regulate the marine space. They must also set targets for the impacts of other economic sectors in the ecosystem (Olsen et al. 2016: 293).

Offshore environmental monitoring surveys are traditionally conducted every three years by independent institutions. They manually collect samples of the water (e.g., temperature, salinity) and of the sea floor ecosystem using boats or floating buoys. There can be a time lag of nine to twelve months before the summary report with the data is ready for use, so the surveys cannot provide day-to-day corrective feedback.

## Environmental Computational Sensing Technologies and Timescaping

Norway has developed heavily instrumented and automated oil fields. These use both people and technology to remotely monitor, model, and control processes in a collaborative, safe, and environmentally

friendly way to maximize the value of field life (Rosendahl and Hepsø 2013). As a result, environmental computational sensing technologies are also increasingly becoming an integrated part of oil development. As Jennifer Gabrys (2016: 7) explains: "Environmental sensors are input devices that facilitate monitoring, measuring, and computing. Yet on another level, environmental sensors can be described as engaged in processes of individuating by creating resonances within a milieu, where individual units or variables . . . are also operationalizing environments in order to become computable." The introduction of computational sensing technologies in the oil and gas industry in Norway and across the Arctic is bound up with the generation of new milieus, relations, entities, occasions, and interpretive registers of sensing.

Our research questions are thus twofold: How are real-time data feeds, sensor platforms, and simulation algorithms influencing the established dynamics between stakeholders in the Norwegian Arctic? More specifically, how does this approach to risk mitigation inform contestations over control between oil and fishing interests in the region?

The adoption of such computational sensing technologies unfolds as an ongoing process of relationship-building and maintenance, which is both embedded in and productive of the environment (Carse 2014). These technologies do not simply detect and report external phenomena, but they give rise to experiencing entities and thereby actualize new arrangements of environmental sensing and data, a process of "creaturing" data (Gabrys 2016). These environmental "creatures" materialize through distinct ways of perceiving and participating in environments. Some may have scientific legitimacy, but others contest scientific modes of evidence. Sensors converge with environments to map ecological processes as diverse as tracking the migration of marine mammals and fish to checking pollutants to facilitating citizen participation. Sensor applications program not only environments but also the sorts of groups, collectives, and practices that emerge to connect technology, nature, and people.

The development of a temporal and spatial order in the marine environment through computational sensing technologies is the development of an information infrastructure. Information infrastructures are sociotechnical ensembles of people, systems, standards, and work practices. They have epistemological and political implications, shaping our knowledge of the world and defining what can be known (Bowker and Star 1999). They are alive and dynamic, political in the sense that often serve "as the catalyst for controversies and thereby contribut[e] to the transformation of political situations" (Barry 2015:

153). We are particularly interested in the epistemological power of infrastructures as it relates to temporal and spatial reordering. Efforts along these lines are emerging not only in government and research initiatives (e.g., Lamers et al. 2016), but also in vendor and oil company initiatives (Parmiggiani and Monteiro 2016). Across sectors of society, computational sensing technologies are generating distinct ways of programming and concretizing environments and environmental relations, even as their sensors inform our engagements with environmental processes and politics.

What drives the adoption of infrastructures in oil company initiatives is often managing risks of a late modern kind, risks shaped by the scientific and technological progress of society (Beck 1992; Knol 2010; Parmiggiani and Monteiro 2016). Risk-assessment methods typically stress that controlling risk means increasing knowledge of the ecosystem, making new uncertainties calculable. When knowledge becomes quantifiable, uncertainty is reduced and becomes manageable. Risk then becomes a product of the probability of an event in relation to its consequences (Knol 2010). Probability is usually calculated based on series of historical data. What happens when probability is calculated and continuously updated based on real-time data feeds, however, remains an uncharted scenario.

An underlying theme here is the way risk is tied to interdependent temporal and spatial regimes. One way of framing this mutual interdependence is in terms of "timescapes" (May and Thrift 2001) which can be understood as networks of representations, technologies, disciplines, and rhythms in time. The extent and content of a timescape is mapped through a process of inquiry in which an analyst's questions are brought into relation with a material field site that has both human and nonhuman elements. Working in and on time involves an encounter with the material world, the limits of the body, multiple tools, and coordinations of diverse rhythms and representations (Bear 2016). Timescaping is, for us, a practice of handling space and time within information infrastructures. The forms of skillful making enacted through these timescapes bring social worlds into being and link them to nonhuman processes.

As human geographers have established, space is not a "container" in which other entities or processes happen. Any space or place is rather the consequence of achievements made up of relations between multiple entities, which are processual and relational in character. The ocean can thus be seen as the product of relations between heterogeneous elements that are simultaneously natural, social, political, economic, and cultural. The ocean environment is a sphere

of "dynamic simultaneity" (Massey 2005: 111), with multiple open-ended, interconnected trajectories.

The complex interaction and collaboration that happens at temporal and spatial boundaries between different actors has been described by Paul Carlile (2004) as a three-fold challenge. These challenges are also relevant for actors involved in ocean timescapes. The first challenge is that of difference; the development of a new understanding of the ocean requires competence from different domains. However, this knowledge is developed and situated in different communities of practices and institutions. Second, there is dependency; actors involved in the oceans are dependent upon each other and must coordinate themselves in space and time to create an understanding. If there is no dependency between parties at the boundary, there is no interaction of consequence. Third and last is the degree of novelty that emerges. This new understanding of the ocean must be cocreated across temporal and spatial boundaries.

Carlile (2004: 557) uses the term *novelty* deliberately. Uncertainty often denotes a statement from the outside (outside of actual time and space) that all is not known in an environment like the ocean. Novelty, on the other hand, suggests no external vantage point. Novelty is specific to a particular situation that involves certain actors in certain times and places, rather than a general condition of uncertainty or ambiguity. The presence of novelty relative to past experiences requires actors to identify and respond to the consequences of emerging dependencies, as well as addressing known interdependencies. This framing enables us to grasp the participatory and relational nature of what an actor needs to share and to assess. Carlile also argues that, in contrast to uncertainty, novelty does not allow us to take for granted that what is new will easily be recognized as unknown. Knowledge also comes at a cost. Actors face the challenge of identifying the consequences of novel circumstances; when novelty increases, the amount of effort required to adequately share and assess knowledge increases as well.

If we bring Carlile's approach to bear on timescaping, it is possible to see two ideal types of timescapes. Carlile describes the first timescape as a short-term, high-confirmation, low-novelty/uncertainty timescape and the second as a long-term, low-confirmation, and high-novelty/uncertainty timescape. Computational sensing technologies naturally vary in their capacities to represent novelty and to confirm its value and consequences. If these technologies provide rapidly updated information about current consequences in time and space, then the value of actions taken should be easy to confirm. A timescape struc-

tured along these lines has a strong and convincing promise of control and reduction of risk. On the other hand, computational sensing technologies that aim to register long-term consequences of action are on a much longer information cycle with higher novelty and risk; as a result, consequences are harder to evaluate compared to the former timescape. Temporal and spatial features are more complex such that the consequences of action cannot be seen directly and control cannot easily be achieved. Getting oriented to this new timescape thus requires capabilities to develop novel courses of action and to confirm their value.

So how does this conceptual schema help us to understand novelty and risk at the boundary of fishing and oil extraction in the Norwegian Arctic? Oil companies want to reduce risk and operate in a domain where they have a high confirmation of the consequences of action taken, that is, a comfortable, low-novelty timescape. Novelty makes everyday operations difficult and risky. However, many ocean ecosystem management challenges cannot be addressed within this timescape. There are long-term, low-confirmation, and high-novelty issues involved because of the complexity of the environment (Pilkey and Pilkey-Jarvis 2007), and so the infrastructure and methods used to study and confirm consequences must be of a long-term, high-novelty type.

Artifacts like computer models embedded in software and wider information infrastructures are increasingly used to coordinate events and actions. Such technologies are making it possible to continuously share environmental data via objects that are associated with attributes based on real-time measured or modeled data. Examples of high-confirmation readings are temperature and salinity measurements. These represent fixed measurements from given sea locations, which can be confirmed over very short time intervals. Infrastructures and practices with lower confirmation, higher novelty, and significant temporal delays of months and years between observation and action are more difficult to evaluate.

With computational sensing technologies, the universe of what can be confirmed about the ocean environment in real-time expands and a new temporal and spatial order, a new way of seeing risk, is emerging that may tip the balance between the two timescapes—the short- and long-term perspectives. In what follows, we present two cases that explore the implications of using real-time data in environmental monitoring, especially with respect to changes in the existing timescapes of fishing and oil. First, we discuss the development of a seabed ocean observatory where real-time environmental monitoring

provides the basis for a new spatial-temporal order. Second, we follow the development of an ecosystem modeling framework that simulates the outcome of a large oil spill on cod stock. Some of these inputs to this framework are expected to come from real-time sources. The case data is based on the two authors' ethnographic studies of environmental monitoring initiatives in the Norwegian oil and gas sector, and reflects our joint, ongoing deliberations over the course of our long-term collaboration.

### *Case 1: A New Real-Time Environmental Infrastructure*

In parallel with the development of technologies that allow oil and gas to be extracted from increasingly inaccessible offshore areas, the regulations for remote environmental monitoring in Norway have also changed over time. The Petroleum Safety Authority of Norway has begun to focus on a more continuous and integrated approach to the monitoring of the natural environment, as opposed to traditional, sporadic risk assessment rounds. Yet it is important to note that a continuous and integrated approach to monitoring would not be possible without the development of computational sensing technologies.

Given Norway's strategic location, an oil company that we call NorthOil (where one of us conducted long-term research) decided to gather baseline knowledge of environmental behavior in the Lofoten Vesterålen area, between the more familiar Norwegian Sea and the unwelcoming High North. In the mid-2000s, the company participated in the installation of a subsea sensor network approximately twenty kilometers off of the Lofoten islands. The project was conducted in collaboration with both European marine research institutes and technology vendors, and it leveraged funding from an EU research project. Since there was no direct connection between this activity and the company's existing operations, the internal funds available were quite limited. The resulting observatory consisted of a metallic semiconic structure equipped with a few off-the-shelf sensors to detect basic environmental parameters, e.g., sound, pressure, temperature, turbidity, chlorophyll, and water-column biomass. Finally, a camera was placed on a satellite crane to take pictures of the sea floor coral reefs. Datasets were stored on a hard drive at the subsea observatory and retrieved at regular intervals.

Although the prospect of opening Lofoten Vesterålen to oil and gas activities remains uncertain, NorthOil invested considerable manpower and scientific expertise in setting up the observatory. As of 2022, the ocean observatory is still operational and several new subsea obser-

vation modules have been deployed. The project soon came to the attention of company management, which regarded it as strategically relevant to obtaining permission to operate in the region as well as engineering new approaches to monitor environmental risk.

There were two ways in which the complexity of the environment in this context was turned into measurable objects, consistent with the timescape of the oil and gas industry. First, in late 2011, the Production and Development Department at NorthOil provided the necessary funds to upgrade the observatory into a real-time monitoring station. In 2013 the observatory was connected to the shore with a fiber-optic cable, through which data could be stored at a small data center located in a wooden cabin. At last, environmental datasets were available in real-time.

Second, NorthOil began a research and development project in cooperation with other Norwegian oil services companies. This project aimed to define a new set of work practices to gather and interpret environmental datasets during all phases of oil and gas operations. The need for a real-time approach to environmental monitoring during all operational phases was summarized by a NorthOil environmental advisor, who explained how the company could use the data to provide evidence for their ability to drill safely and ultimately to increase the operational window available to them:

> We want to look at different types of possible technologies or methods to get this done. . . . Our argument is that, if we can measure the biomass, we can maybe avoid having a general stop, for example, to the drilling activities in a given period. If we can argue that we can measure when the biomass comes, either when the fish comes or goes or when the spawning products come back, so we wish to argue that we can stop on time before the products come, for example. So you can control the drilling and optimize your drilling (environmental advisor, oil and gas company, interview, February 2014).

The Lofoten Vesterålen monitoring station became central to this initiative. The datasets it produced were fed into a publicly accessible web portal, where any interested party could peek into the current situation of the sea floor and even download the data for further use. However, although the portal was successful as a tool to attract public interest in the need to monitor the health of the area's marine environment, it did not do enough to tie the initiative to NorthOil's operational context.

One problem in this respect had to do with the visualizations used in the web portal. A typical way to display measurements of sea current strength is the chromatogram, where measurements are plotted

in time and assigned different colors based on the concentration of marine biomass at a given depth. A chromatogram of the area surrounding the monitoring station was displayed on the web portal. However, its temporal granularity did not suit the temporal frames of the main users of this monitoring technology, namely environmental experts and drilling engineers.

On one hand, the chromatogram's granularity was deemed excessive by environmental experts involved in the NorthOil project, because users of the analyzed data want to receive results monthly and their databases are not prepared to ingest such detailed datasets. On the other hand, the chromatogram did not stack up to the visualizations used by drilling engineers, who must decide quickly whether to continue or to halt drilling operations. Such visualizations must convey the level of risk in a clear and effective way, normally with the use of a standard color palette to which engineers are trained to respond.

Consequently, the project had to approach data visualization in a different way. Leveraging existing risk assessment procedures in use in control rooms, NorthOil and the other participating companies decided to discretize the water column into bands of values. They drew on an indicator of "environmental value" first developed by the Norwegian Directorate for the Environment to summarize the concentration of biomass like fish in the water column. The environmental value is calculated by collapsing the sections originally scanned by the echosounders into larger chunks; measures are also given hourly instead of every few seconds.

More work had to be done, however, to correlate the biomass concentration levels with the time of the year, in order to indicate the beginning and end of the spawning season. The operational window for extraction could therefore be set outside of this interval. The implication of this approach was that environmental value must be a relative measure: it means different things in different moments and locations. Two fish in usually deserted areas represent a high concentration, whereas two fish in an otherwise densely populated spot mean a low concentration. These scales therefore had to be calibrated with historical data, which the project imported from external institutions who had collected them for research (thus, nonoperational) purposes. This choice, however, introduced problems in merging the imported datasets with the one generated by the Lofoten Vesterålen monitoring station. As mentioned, the sensors originally installed in the observatory were inexpensive off-the-shelf digital devices. Thus, two more advanced current profilers were installed in hopes of improving data quality.

Today, real-time environmental monitoring strategies are being established by creating an in-house information infrastructure composed of new and adapted hardware and software technologies operated by both engineers (e.g., while drilling) and environmental experts. Two distinctive features characterize this new approach to monitoring. On the one hand, it is embedded in the oil and gas information ecology for remote monitoring, enabled by computational sensing technologies and adapted to the specifics of the Norwegian context. On the other hand, external stakeholders including research institutions and fishing communities are also enrolled, owing to their expertise in areas that oil companies are lacking. Different perceptions of time guide the work practices of all of the stakeholders involved. Then, too, environmental cycles may vary over time and the impact of human activities may become apparent over decades or centuries. The enactment of environmental risk via real-time environmental monitoring emerges as a way to commensurate different timescapes.

### *Case 2: Novelty and Ecosystem Modeling*

Ecosystem-based risk modeling forms the basis of an ecosystem management strategy whenever a new area is opened for petroleum activities in the Norwegian Arctic. The modeling specifically addresses the risks of a worst-case scenario in the form of an oil spill in the area. This is a complex timescape with many facets: the challenges it poses are marked by high novelty and a low confirmation of knowledge, a high dependence on collaboration at the boundaries between disciplines, and volatile political conditions.

The Institute for Marine Research has asserted that an oil spill in the Lofoten Vesterålen area could lead to a range of effects on cod stock, from minimal to devastating (Helgesen and Tunmo 2009; Blanchard et al. 2014). The open-endedness of this assertion underscores the high-novelty and low-confirmation character of the ecosystem. Both oil companies and the authorities have argued that a clearer picture of the risk could be achieved if more research were carried out (Helgesen and Tunmo 2009; Knol 2010).

The biggest difference between these stakeholders is their respective understandings of ecosystem dynamics, which are underpinned by spatial and temporal assumptions about the functioning and productivity of the ecosystem. The Institute for Marine Research argues that the long-term effects of oil spills cannot be evaluated without high uncertainties, since "there is no exact science behind the numbers that are used to measure environmental risk" (Helgesen and Tunmo

2009; our translation). Yet new government research and oil industry funding is being channeled into the need to improve risk-based methods and increase the understanding of the ecosystem. Computer-based ecosystem modeling, in particular, has become important for simulating short- and long-term environmental effects.

The SYMBIOSES initiative was funded by the Research Council of Norway between 2011 and 2014. It was undertaken by a consortium of basic and applied research institutions, with additional financial support from the oil industry. The integrated modeling framework that it developed, known as SYMBIOSES, uses a state-of-the-art method for impact assessment of acute spills on fish populations and it builds on the scientific literature for its various sub models. The framework calculates larval abundance with and without the presence of oil and then produces an estimate of a total cod population. A quote from the SYMBIOSES project manager during a presentation at the Arctic Frontiers conference in 2017 captures this space of uncertainty:

> To create large oil spills in the natural environment is out of the question. We use existing simplified models in these complex simulations that can assess the outcome of oil spills and the possible consequences for cod. For other species, there can be other consequences, but future studies aim at addressing this. . . . To be able to analyze the effects of large spills, a thorough understanding of several processes are needed. We need to understand the movement and endpoint of oil in the sea, the dispersion, movement, and interaction between cod larvae and what they eat. Further, we also need to model the connection between biological effects and the toxicity of the oil and the effect of oil on cod larvae. There are also natural processes of death and regulating mechanisms like cannibalism that must be accounted for . . . of a million eggs, only six or seven become adult cod (project manager SYMBIOSES, Arctic Frontiers conference presentation, February 2017).

To be computable, the health of the cod must be quantifiable and standardized. In SYMBIOSES, the effect of oil on cod eggs and larvae is dependent on the length and amount of exposure, as well as the properties of the oil. The effect on individual cod eggs and larvae are calculated as a function of chemical concentration in the water, and the following key parameters are used: threshold value, mortality rate, and elimination rate.

In general, the threshold value represents a harmless concentration of chemicals. If exceeded, additional effects can emerge depending on the exposure time, which must be long enough for the substance to accumulate in the organism. The model quantifies how fast the

chemical substance is absorbed in the organism (elimination rate), when the effect is initiated, and its strength (mortality rate). The interaction between these parameters leads to different responses and has various degrees of sensitivity based on the level of and length of exposure.

The oil industry argues that there is a tendency to make ecosystem modeling too conservative and that precautionary principles should not be put into the calculations, but researchers contest this position. Furthermore, the industry argues that one should start with the most straightforward inputs and then add the safety margins in the end: otherwise, "to fold in precautionary elements here and there makes the result more difficult to interpret" (Helgesen and Tunmo 2009; our translation). However, a safety or uncertainty factor is also linked to threshold values. One marine biologist explained:

> Since there is a lack of eco-toxic data for most species and because most threshold values are derived from lab studies, it is difficult to create a proper threshold value. We are confident that we have one for cod, but the threshold value will also differ across the life of a cod and across species. Most species are more vulnerable in the egg and larvae life stages and will have a different threshold value in later stages of life (project manager SYMBIOSES, Arctic Frontiers conference presentation, February 2017).

SYMBIOSES ran simulations of different scenarios after an oil spill, including different oil spill rates, depths of oil spill release (sea surface vs. seabed), lengths of spill, and types of oil in relation to a number of toxic threshold values for the cod. The same scenarios were also run without oil to analyze the development of a cohort of cod and larvae without an oil spill. The project manager of SYMBIOSES argued at the 2017 Arctic Frontiers Conference:

> The simulations showed that a worst-case oil spill scenario with 4500$m^3$ of oil per day over ninety days led to a 43 percent reduction of survival of the eggs and larvae in the particular year-class of cod. Most simulations resulted in between a 0 and 10 percent reduction in the survival of eggs and larvae. The natural mortality rate of eggs and larvae also vary without the oil spill. In most scenarios with adult cod, the total biomass was reduced by less than 3 percent. Species like cod have several year-classes that contribute to the total biomass and will not necessarily be heavily influenced by a spill that hit one generation very hard. . . . In our simulations, we also discovered that 43 to 61 percent of the oil released went through a weathering process and was biologically degraded or evaporated. Just 3 percent ended up on the beach (project manager SYMBIOSES, Arctic Frontiers conference presentation, February 2017).

Hauge and colleagues (Hauge et al. 2014) argue that uncertainty cannot be fully quantified when facing ignorance (or high novelty), since it cannot address what we do not know beyond our conception of what is possible. There are many poorly understood ecosystem processes that could influence the cod stock. The main sources for uncertainty are that historical data may not fully be representative for the future. There are also several factors that contribute to uncertainty in assessing the probability of a blowout. The political, geological, and environmental conditions of available empirical data (itself scarce) will never be identical to any other situation. The effects of innovation, from technical developments to marginal improvements in routines, are difficult to incorporate. There are also sources of uncertainties related to the area itself: the grid resolution of the models for ocean currents and hydrography is coarse, and weather conditions are complex and indeterminate.

The high novelty of this timescape was also stressed by another marine biologist conducting research on toxic threshold values in fish:

> We see several effects on fish exposed to oil in controlled lab tests. Effects can be acute, meaning reduced survival, or more long-term chronic effects like immune system changes. How to establish the link between the lab tests and real effects on the ecosystem is a complex subject matter. . . . Of course, we can detect dead fish during an oil spill and the whereabouts of fish and biomass in real time by using, for instance, echosounders. But there is no real-time method of measuring the many biological parameters we are looking for [in order] to understand the long-term influence of petroleum activities on fish (environmental researcher 1, interview, November 2014).

With the degree of novelty presented above, more knowledge is clearly needed both for short-term risk mitigation and policy guidance. How does this influence the use of a modeling framework like SYMBIOSES? The oil companies sponsor SYMBIOSES to gain knowledge about opening new areas in the Arctic, but also to adjust their operational models in light of the new situation. The link to real-time data feeds is critical, as a way to reduce the risk and uncertainty around the models. An oil industry manager argued:

> SYMBIOSES is important in developing the license to operate because, with this framework, we can model different outcomes. Regardless if they open Lofoten [to drilling], we need this capability in the rest of the Arctic. The plan should also be to use real-time data as the input in the submodels of SYMBIOSES. We can already import real-time temperature, salinity, and currents into the hydrographic and oil circulation models (oil and gas company manager, interview, March 2014).

A researcher based in one of the research organizations adds:

> Today's models do not have sufficient time series to cover natural variation over longer time periods. For temperature and currents data, we historically have days or weeks measurements of data taken during surveys. This we use to develop an average value. Real-time feeds that track the natural variation of temperature and currents over the year on the seabed and in the water column would improve the model predictions. Several oil companies now place monitoring equipment on the seabed. We have access to this data and can use these real-time measurements [to make] predictions (environmental researcher 2, interview, November 2014).

The link to real-time data feeds is critical. It is a way to reduce the risk and uncertainty around the models making new uncertainties calculable. However, it remains to be seen if this new knowledge of the ecosystem reduces uncertainty and makes it manageable.

## Conclusion

When environmental monitoring becomes a computational sensing infrastructure, it creates a real-time, online, and public subject out of what was an offline and slow practice. In the process, timescapes shift. Representations of the Arctic ecosystem circulate beyond their original setting, and new temporal and spatial dimensions emerge along with new associated risks. Timescapes are never neutral: their biases become visible through their consequences, as brought about by actors' scientific and political practices. In this chapter, we have argued that real-time environmental monitoring is an information infrastructure and timescape in the making, which can either create barriers or possibilities for knowledge development at a boundary. Tracking these developments in the Norwegian Arctic prompts us to grapple with what is about to emerge as infrastructural (see also Parmiggiani and Monteiro 2016).

In the first case presented here, we examined how computational sensing technologies enable continuous sharing of environmental data via objects that are associated with attributes based on real-time measured or modeled data. Such sensor networks move infrastructure toward a higher-confirmation and lower-novelty timescape, because these digital representations are now available on the desktops of professionals working in this domain. This new infrastructure can also be used for risk mitigation and management.

In the second case, we showed how the spatial and temporal domain of the Arctic ecosystem is increasingly modeled through computational simulation frameworks. The framework we discussed, which simulates the outcome of a large oil spill on cod stock, has many novel features since the uncertainties associated with modeling makes prediction difficult. In this timescape, it is hard to confirm the consequences of action to secure the ecosystem's long-term well-being.

Oil companies inhabit a timescape that has traditionally been used for regulatory control of energy installations, and it has worked well in that domain because it has dealt with relatively few variables in dynamic, but linear systems. Sensors have been used in this context to manage basic control variables like flow, temperature, and pressure. They make up a powerful temporal and spatial information infrastructure, and it is not surprising that the industry is inclined to use this timescape to manage emerging knowledge domains. Real-time information flows provide almost instant feedback and confirmation of actions taken, allowing an oil company to take actions that control the production of oil. This timescape is also easy to align with the prevailing risk management approach in oil and gas.

When we consider the slow temporal rhythms and the novelty of marine biology and ecosystem research, though, we see information that comes from a variety of sources and that may need significantly longer time scales to be confirmed. This timescape is radically different. For instance, the consequence of growth in the level of toxic substances in haddock cannot be confirmed in the same instant manner. Discerning it will require lab studies, a better understanding of species-dependent toxic threshold values, and an analysis of the condition that led to increased toxicity across sites. Is it the consequence of old oil-based mud piles on the seabed, or the influence of forty years' exposure to low concentrations of oil in the water? Such a question cannot be answered with the short-feedback confirmation loops of the oil industry's present timescape. There are significant time delays between knowing the consequences of information about the environment and the consequences of the actions taken to manage it.

Thus, an information infrastructure biased toward the short-term and toward real-time feedback is difficult to override, given the higher confirmation potential of the consequences it detects. The timescape that researchers argue will enable a richer understanding of the ecosystem is very different. According to Haugen and colleagues (2014): "An ideal assessment of environmental impacts would include the effects on every single species in the area, every stage of their life

cycle, cascading effects on the ecosystem components, all possible impacts on the environment, and both the short and long-term effects" (Haugen et al. 2014: 83). Such an assessment is difficult to imagine in practice. Still, to apply control theory–inspired oil and gas timescapes in the high-novelty circumstances of the Norwegian Arctic will create a problematic mismatch between the spatial-temporal infrastructures of fish and oil interests, which have different ways of determining the value of information about the ecosystem. To balance these timescapes is difficult when real-time measurements offer greater capacity for confirmation than do artifacts and infrastructures used to represent the long term and its consequences for the environment. When the temporal gap between the collection and publishing of environmental data shrinks to zero, environmental risk is no longer a long-term effect but traceable on the portals and desktops of the stakeholders. One timescape is then in control.

As a result, computational sensing technologies stand to tame the disruptiveness of both time and space. Central to the history of modernity has been a translation of spatial heterogeneity into temporal sequence; different places are interpreted as occupying different stages in a single temporal sequence. It is possible to interpret contemporary changes in environmental monitoring practices from campaigns to real-time monitoring in the same way. In our cases, this pace can effect a "taming of the spatial," in Doreen Massey's (2005: 61) words. Esther Weltvrede and colleagues (Weltevrede, Helmond, and Gerlitz 2014) use "realtimeness" to characterize a similar phenomenon. Realtimeness unflattens general accounts of real-time computational sensing technologies and draws attention to the agencies built into the front end of specific platforms and the back end of political economies of sorting, processing, and organizing content. Like us, Weltevrede and colleagues show how the fabrication of real time often has a complex simultaneity, an interplay of past, present, and future elements folded into algorithmic calculations.

The emerging information infrastructure of real-time data, from sensors to simulations, is changing established timescapes and understanding of risk among actors in the Norwegian Arctic. It poses the consequential question: will environmental risk develop a bias toward the short term that can be confirmed and made visible? We have argued that the emergence of quick and reliable computational sensing technologies, coupled with risk and control regimes originating in the oil and gas industry, may make it more difficult to address the complex and novel issues associated with energy development that cannot be understood by instant feedback processes. Yet the effects of

this shift are just becoming perceptible to social analysis, and future research is needed to understand how this new timescape will change the face of the Arctic.

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## References

Barry, Andrew. 2015. "Discussion: Infrastructural Times." Editor's Forum: Theorizing the Contemporary, *Fieldsights*, 24 September. https://culanth.org/fieldsights/discussion-infrastructural-times.

Bear, Laura. 2016. "Time as Technique." *Annual Review of Anthropology* 45: 487–502.

Beck, Ulrich. 1992. *Risk Society: Towards a New Modernity*. London: SAGE.

Blanchard, Anne, Kjellrun Hiis Hauge, Gisle Andersen, Jan Helge Fosså, Bjørn Einar Grøsvik, Nils Olav Handegard, Matthias Kaiser, Sonnich Meier, Erik Olsen, and Frode Vikebø. 2014. "Harmful Routines? Uncertainty in Science and Conflicting Views on Routine Petroleum Operations in Norway." *Marine Policy* 43: 313–20.

Bowker, Geoffrey C., and Susan Leigh Star. 1999. *Sorting Things Out: Classification and Its Consequences*. Cambridge, MA: MIT Press.

Carlile, Paul R. 2004. "Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries." *Organization Science* 15(5): 555–68.

Carse, Ashley. 2014. *Beyond the Big Ditch: Politics, Ecology, and Infrastructure at the Panama Canal*. Cambridge, MA: MIT Press.

Gabrys, Jennifer. 2016. *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet*. Minneapolis: University of Minnesota Press.

Hauge, Kjellrun Hiis, Anne Blanchard, Gisle Andersen, Ragnhild Boland, Bjørn Einar Grøsvik, Daniel Howell, Sonnich Meier, Erik Olsen, and Frode Vikebø. 2014. "Inadequate Risk Assessments—A Study on Worst-Case Scenarios related to Petroleum Exploitation in the Lofoten Area." *Marine Policy* 44: 82–89.

Helgesen, Ole K., and Truls Tunmo. 2009. "Beskyldes for å sabotere oljedebatten." *TU*, 24 April. http://www.tu.no/petroleum/2009/04/24/beskyldes-for-a-sabotere-oljedebatten.

Knol, Maaike. 2010. "Constructing Knowledge Gaps in Barents Sea Management: How Uncertainties Become Objects of Risk." *Maritime Studies* 9(1): 61–79.

Lamers, Machiel, Alexey Pristupa, Bas Amelung, and Maaike Knol. 2016. "The Changing Role of Environmental Information in Arctic Marine Governance." *Current Opinion in Environmental Sustainability* 18: 49–55.

Massey, Doreen. 2005. *For Space.* Thousand Oaks: SAGE.

May, Jon, and Nigel Thrift, eds. 2001. *Timespace: Geographies of Temporality*. London: Routledge.

Olsen, Erik, Silje Holen, Alf Håkon Hoel, Lene Buhl-Mortensen, and Ingolf Røttingen. 2016. "How Integrated Ocean Governance in the Barents Sea Was Created by a Drive for Increased Oil Production." *Marine Policy* 71: 293–300.

Parmiggiani, Elena, and Eric Monteiro. 2016. "A Measure of 'Environmental Happiness': Infrastructuring Environmental Risk in Oil and Gas Offshore Operations." *Science and Technology Studies* 29(1): 30–51.

Pilkey, Orrin H., and Linda Pilkey-Jarvis. 2007. *Useless Arithmetic: Why Environmental Scientists Can't Predict the Future*. New York: Columbia University Press.

Rosendahl, Tom, and Vidar Hepsø. 2013. *Integrated Operations in the Oil and Gas Industry: Sustainability and Capability Development*. Hershey: IGI Global.

Weltevrede, Esther, Anne Helmond, and Caroline Gerlitz. 2014. "The Politics of Real-time: A Device Perspective on Social Media Platforms and Search Engines." *Theory, Culture and Society* 31(6): 125–50.

CHAPTER 4

# Wild Lands, Remote Edges

## *Formations and Abstractions in Greenland's Resource Zones*

Mark Nuttall

A self-governing territory of the Kingdom of Denmark with growing ambitions for political independence, Greenland is often featured in scientific and media reports about global warming, as well as plans to exploit the resource potential of Arctic subsurface environments. The world's largest island is being brought into sharper international focus as the effects of climate change, the prospect of busier northern sea lanes, the articulation of Indigenous people's rights, conservation challenges, and security issues in the Arctic all attract greater attention from a diverse range of global interests. The seasonal melt of parts of the Greenland inland ice, which covers 80 percent of the country's landmass, is increasing in summer (Box and Decker 2011; Ryan et al. 2018), while summer sea ice is decreasing in northern Greenland, the Arctic Ocean, and other parts of the High Arctic. Scientists with long-term experience of researching and monitoring sea ice have warned that the Arctic Ocean's perennial ice cover may disappear entirely before 2050 (e.g., Stroeve et al. 2012; Wadhams 2012; Wang and Overland 2009; Wilkinson and Stroeve 2018). Others suggest that parts of the Arctic Ocean and surrounding seas are beginning to resemble the Atlantic in terms of climate, as warm (and saltier) water inflow affects sea ice variability and marine productivity (Årthun et al. 2012; Polyakov et al. 2017). With Arctic ecosystems in flux, the implications are not just environmental but also geopo-

litical and geostrategic, carrying economic costs and opportunities. Social, economic, personal, emotional, and embodied effects are also increasingly apparent in many parts of Greenland and are especially marked for those people who depend on fishing and hunting for their livelihoods. As they witness the transformative effects of decreasing sea ice, glacial retreat, coastal erosion, and changes to animal behavior and movement, their livelihoods stand to be deeply affected (Hastrup 2018; Nuttall 2017, 2019a, 2019b).

But scientific accounts of climate change and, in particular, the visual representations of melting ice and warming waters—through satellite images, amplification graphics, and charts depicting temperature, ice cover anomalies, and icy fragments—also provide essential aesthetic elements for a lively political and economic narrative, as well as for the emergence of a liquescent geopolitics. In Greenland, this narrative aims to be persuasive about the prospects and possibilities arising from the emergence of an extractive resource frontier constituted by wild, remote places with subsurface riches that are increasingly accessible as the ice disappears. A warming Greenland, characterized by thinning sea ice and glacial retreat, may mean that hunters and fishers in some parts of the country face restrictions and frustrations in their customary movements around their localities, even as new forms of mobility through and across Arctic waters and landscapes are enabled for geophysical exploration crews, seismic survey ships, and the flows of capital, investment, expertise, skills, and labor needed for resource industry projects.

Arctic transformations are thus entangled with human and nonhuman mobilities and immobilities in a shifting, increasingly liquescent world (Nuttall 2019b). The objects and technologies of extractive industry, along with networks of knowledge, expertise, and social relations surrounding and supporting extraction, circulate in, around, and between particular kinds of geo-assemblages (Dodds and Nuttall 2019). In this chapter, I argue that mining and hydrocarbon projects, as well as infrastructure development, in a Greenlandic context can be approached as informing and even constituting an abstractive industry, which involves anticipation, speculation, and hope as well as the imagination of resource potential (see Nuttall 2012; Weszkalnys 2015). I illustrate this claim with: discussions of the marking out of extractive resource zones; the development of a zinc-lead mine at Citronen Fjord on Greenland's northern coast; recent oil exploration activities in Melville Bay and associated debates over the sustainability of hunting and fishing communities; and conclude with reflections on the development and spatial transformation of Nuuk as a dynamic,

capital city in a "new" Arctic. An examination of these sites shows how abstraction, as a special case of extraction, carries very real social and environmental effects. Furthermore, I argue that abstraction involves an emphasis on the wild, remote, and the distant. Remoteness, as Edwin Ardener (1987) pointed out, has as much to do with how spatial difference is conceptualized as it does with geographical coordinates, and is mobilized as political and economic process (Saxer and Andersson 2019). Greenland's ancient bedrock seems fixed and immutable, and much of its terrain is often described as being remote. Yet Greenland as territory exhibits and expresses itself as something stretchable, always undergoing a process of becoming, brought into being and unsettled by an ensemble and assemblage of human and nonhuman actors, processes, pressures, and forces (Dodds and Nuttall 2018, 2019; Nuttall 2017). In this way, while some places are being transformed as extractive sites, others remain speculative zones for exploration. And, to paraphrase Marion Shoard (2000), some are abstracted as edges of promise. As Cons and Eilenberg (2019: 2) point out, it becomes vital to understand the various forces and processes that are assembled to invent, reinvent, and incorporate remote places, margins, and edges as zones of opportunity.

## Marking Resource Zones

Developing a mining industry and encouraging exploration for oil and gas have remained stated aims of the various permutations of the Greenland self-rule government over the past few years, as politicians push forward with strategies for reducing dependency on Denmark, forging a sustainable economy, and enhancing Greenland's agency in international politics (Nuttall 2017). Essential to these aims is the geological mapping and representation of the vertical and volumetric dimensions, as well as the materialities, of the subsurface and seabed. The history of geological investigations and assessment of minerals in Greenland stretches back to the beginning of the nineteenth century, and in recent decades a number of large-scale mining operations as well as oil exploration activities have taken place. However, geological strata and the subterranean have become far more central to ideas about sustainability and the strengthening of Greenland's economy since the country achieved a greater degree of self-government in 2009 and acquired ownership of its subsurface resources at the beginning of 2010.

Despite talk of Greenland's resource potential, however, there is very little extraction of minerals actually taking place in the coun-

try, and oil and gas companies have not moved beyond exploration phases. Offshore waters have been an initial focus for oil companies, while fells, hills, and mountains—often in places considered remote parts of the country—are sites of exploration for minerals. But projects that are seen to be promising, engendering public debate and provoking environmentalist opposition, often fail to materialize. Why? Because global markets do not, in the end, appear to be favorable (and companies fear they will not recoup the enormous costs of exploration and exploitation), because of a lack of investment, or because of technical and environmental challenges in remote locations. Remoteness is attractive, but risky.

Disruption to extractive industries has also resulted from the rapid spread of viral infection. In 2014, the Ebola outbreak affected London Mining's operations in Sierra Leone and contributed to its filing for bankruptcy—the company had been planning to develop a large iron ore mine 150 kilometers northeast of Greenland's capital Nuuk. In 2020, the COVID-19 pandemic sent plans for exploration and logistics into a tailspin—and not just in Greenland, of course—and made companies and investors anxious they were about to face a long period of considerable uncertainty. Whatever the reasons for the demise of particular projects, the fundamental political approach reinforced by the government's mineral strategy remains the same: that is, the country's emerging minerals sector should form one part of the economy, even if it does not end up as the dominant sector that many politicians hoped it would. To this end, considerable effort and funding is being put into geological research, attracting mining companies to Greenland (and easing regulatory constraints and bureaucratic procedure), enticing investors, and increasing knowledge of strata and mineral-bearing environments. Through this investigation of the subsurface, geological formations are mapped and resource spaces are measured, marked out, abstracted, and assembled as sites of speculative venture and economic promise. The minerals and hydrocarbons that comprise these spaces and estimations of their value give rise to ideas about sustainable futures.

To take one example, rubies and pink sapphires are now being mined on a large commercial scale near Qerqertarsuatsiaat, a community of around 230 people in southwest Greenland. Prior to the May 2017 opening of the mine, which is operated by Greenland Ruby A/S (part of the Norwegian-owned LNS Group), a form of small-scale artisanal mining did exist in the area, with local people gathering gemstones for sale. Both forms of production involve a process whereby rubies and sapphires are located, extracted, cut, given form, polished, made

into something beautiful and valuable, and sent out to markets. Artisanal mining—gathering stones for local craft and jewelry-making—has provided a means for some people living in the area to earn an income (many also travel to Nuuk to sell the stones there), as does the large-scale production of rubies and pink sapphires by providing jobs in the mine and employment in ancillary industries. While artisanal mining and employment for local people in the new mine provide hope for sustainable livelihoods, Greenlandic politicians and business leaders see the profits from the large-scale mining venture as essential to plans for building a sustainable national economy. The mine is just one of a number of extractive projects that the Greenlandic authorities hope to see developed in the near future, including mining for rare earth elements in the south of the country and lead-zinc mining in the north. However, a change of government in April 2021 put the prospect of a major project at Kvanefjeld near Narsaq in south Greenland in doubt because of environmental concerns. The Australian company Greenland Minerals has been focused on gaining approval for the project, which would extract rare earth elements and uranium, since 2007. Inuit Ataqatigiit has become the largest party in Greenland's parliament and, while pro-independence and not opposed to mining, it has expressed its opposition to uranium mining over the past decade (Nuttall 2013).

Mining ventures, even at the earliest exploratory stages, as well as offshore seismic surveys and the search for oil, assume a political life and a social presence. They are made into capital by virtue of what they promise in terms of their future success and profits. An entire industry has thus grown up in Nuuk and other towns, as well as in Denmark, which involves navigating a broad range of procedures and bureaucracies with distinctive forms of expertise and calculative labor. In my fieldwork in Nuuk over the past few years, I have been particularly interested in the way that this industry makes the emergence of an extractive frontier and the formation of resource spaces in Greenland possible. Consultants, administrators, government officials, engineering companies, and financiers, as well as geological inventories of the subsurface, economic development plans, and other techniques of a lucrative supply, services, logistics, and impact assessment sector constitute an administrative apparatus sustained by speculation and estimation about future projects and their prospects. A focus on the construction and operational aspects of extractive projects ignores this broader context, in which subterranean environments are made visible and their dimensions become subject to economic calculation and valuation. Nuuk is a rapidly growing capital of almost eighteen

thousand people. As a base for these activities and other forms of innovation from telecommunications and digital infrastructure to scientific research, as well as for the distribution of essential goods and supplies around Greenland, Nuuk is not just a center of calculation, to use Bruno Latour's (1987) notion. It has also become a center for abstraction.

The ease of movements to and from spaces of extraction is not only about accessing remote waters to probe the seabed or crossing previously inaccessible terrain to dig deep into the subsurface as melting ice enables entry into remote places. Oil, gas, and mining companies wanting to operate in Greenland also encounter a regulatory process regarded as less bureaucratically complicated, restrictive, and lengthy than those found in other parts of the Arctic, such as northern Canada. Resource development is promoted enthusiastically by the Greenland self-rule government, both in Nuuk and at international venues such as industry conferences and events announcing bids in new licensing rounds. Greenlandic politicians and representatives of government agencies responsible for regulating extractive projects globe-trot each year to Europe, North America, China, and Australia, marketing the country as attractive for (and welcoming of) oil and mining companies. As industries widely linked to climate change move into a country that is ostensibly being opened up by global warming, opportunities for extraction arise from changing conditions like ice melt, a process Leigh Johnson (2010) calls "accumulation by degradation." But some mining and oil companies are also moving out of Greenland as global commodity prices make the region less attractive and as renewable energy projects become priorities, prompting actors in resource-focused agencies to work even harder in cajoling them to stay and encouraging others to invest.

## The Far Northern Mine

In and beyond the activities of oil, gas, or mining companies and their retinue of consultants (Appel, Mason, and Watts 2015), extractive industry involves abstraction and calculation, as well as the formation of frontiers. Michael Watts (2015: 215) points out that frontiers are "time-spaces endowed with quite specific sorts of properties and qualities" by which the conditions for extractive accumulation are put in place. However, to draw on Alfred Whitehead's ([1920] 2007: 85) phrasing, impact assessments, regulatory frameworks, and governance structures for extractive industry seldom, if ever, concern themselves with

how "abstractive elements form the fundamental element of space and time." In Greenland, as in any resource zone, such abstractive elements include speculation in time and space. They also involve geographical imaginaries sustained by cartographies of both the surface and subsurface (as well as oceanic environments, including the seabed), all of which emphasize an aesthetics of geological strata. In this way, Arctic ecological transformations allow for the exposure of geological formations and mineral veins through various processes of visualization and through a politics concerned with the promise and potentialities of the subterranean. As resource economist Erich Zimmermann (1951) put it, resources "become." And so do the places and spaces in which they emerge. Resources and resource zones are not fixed or finite and becoming is as much an ideational process as it is one grounded in material or physical aspects (De Gregori 1987).

In Greenland's remotest regions, mining companies are also engaged in prospecting and assembling resource spaces, as they develop plans for a number of extractive ventures. Ironbark Zinc Limited, an Australian company, is developing a large zinc-lead mine project at Citronen Fjord in Peary Land on Greenland's far northern, uninhabited edge; Oodaaq Island, which lies off Peary Land's Arctic coastline, is the world's northernmost point of land. Note my purposeful use of "remotest," "far northern," "uninhabited edge," and "world's northernmost," for this is how north and northeast Greenland have been described in the annals of exploration, adventure and geological research, as well as by mining companies operating in the country today. Greenland has long been viewed as remote and at the edge of the world—when English explorer John Davis viewed its southern coast in 1585, he called it "the land of desolation." In *The Great Ice Age and its Relation to the Antiquity of Man*, published in 1874, James Geikie described Greenland as an icy, forbidding place. "Fast as the snows deepen and harden into ice upon the bleak wild of Greenland," he wrote, "that ice creeps away to the coast, and thus from the frozen reservoirs of the interior, innumerable glaciers pour themselves down every fiord and opening to the sea. Only a narrow strip of coast-line is left uncovered by the permanent snow-field or *mer de glace*—all else is snow and ice" (Geikie 1874: 56). Travelers in northern Greenland in the late nineteenth and early twentieth centuries often fashioned themselves as adventurers not just in unknown, blank spaces, but in lost worlds. Danish-Greenlandic explorer and ethnographer Knud Rasmussen (1921), for example, considered the glaciers of Melville Bay to be vestiges of the last ice age, while William Carlson, who studied winter air currents in Greenland in the early 1930s, journeyed by

dog sledge to the Cornell and Giesecke glaciers in the northern part of the Upernavik district, and described them as the ramparts of an ice kingdom. Reflecting upon the experience, he wrote of being witness to an "unforgettable drama of vast ice bulks losing themselves in softening shadows, a dreamy melting of night with day shadows, the scenes drifting back past us, changing, darkening; nostalgic drama of perfect theater" (Carlson 1940: 279). Sledging to the front of Cornell Glacier, Carlson felt the Arctic revealed itself as "desolate" and "dreadful in its immense sterility" (1940: 275). These descriptions are of bleakness, the wild, rugged and disorderly, the sublime, the terrible and the awe-inspiring, in what Geikie, Rasmussen, and Carlson, as well as many others who traveled in northern Greenland, thought of as a remote, icy world of unmapped emptiness.

Gazing upon remoteness—and entering into remote places—is often associated with personal transformation. Approaching Greenland by ship in summer 1932, Ernst Sorge and his intrepid colleagues felt they had reached the Arctic once they had sighted their first iceberg. This marked "the real beginning of our expedition," he wrote. "From now on we got the notion we were really off Greenland, and had become polar adventurers. We allowed our beards to grow so as to penetrate these regions in appropriate and professional sort of seeming" (Sorge 1935: 31). Such a description of the appropriate postures and appearances that seem necessary when "entering" the Arctic is consistent with an enduring trope. Exploration and mapping were regarded "as the *conquest* of virgin territory" with the Arctic perceived "as a particularly masculine arena" (Bergmann 1993: 53), an empty space where masculine identities could be expressed and tested (Hill 2008). At the same time as they were moving through remoteness and along the northern polar edges of the globe, Rasmussen and Carlson were aware they were experiencing a disappearing world. Rasmussen thought the glaciers of Melville Bay to be "extravagant," throwing "gleaming ice mountains out into the ocean," but reaching Humboldt Glacier (at 79° North, and the widest tidewater glacier in the Northern Hemisphere) proved a disappointment; he called it a "half-dead ice-stream—scarcely capable of reproduction" (Rasmussen 1921: 59). Carlson wrote of Giesecke's Glacier as receding and affected by powerful tides that swept and undermined its front, so much so that it left a great basin of water at the head of the fjord that was empty of icebergs and other pieces of floating glacial ice (1940: 281).

One of Ardener's (1987) insights is that encounters with remoteness are often accompanied by a sense of loss as imaginary places

are made real—the paradox is that traveling to a remote place is to be aware of its accessibility and hence its vulnerability. More contemporary writing about global ecological crisis has unsettled imaginaries about the nature and the enduring presence of icy places (e.g., Wadhams 2016). As the ice melts, scientific scenarios as well as environmentalist anxieties inform narratives of decay and ruination. These warn that any ice remaining will assume form as fragments left behind by rupture, lingering and floating in Arctic seas, in "the aftermath of the process of breaking apart" (Orban 1997: 6).

There is a long history of geological research and resource speculation focused on Peary Land, which aimed to map and fill in the blank spaces. Lauge Koch first reported on preliminary geological work carried out there during the Second Thule Expedition led by Knud Rasmussen in 1916–18, and then returned in the 1920s to do more exploration of the area. Other geological and topographic mappings took place during the Danish Peary Land expedition in the 1940s, and William E. Davies carried out extensive mapping during US military–sponsored expeditions in the late 1950s and early 1960s—but the large-scale surveying of the region and its resource potential began in the 1970s.

Exploration and assessment of the Citronen Fjord area's lead and zinc deposits followed. This involved a penetration of the area's depths rather than just the mapping of its surface. Since the early 1990s, this has involved several companies with interests in the region's potential, including Platinova, which discovered a sulfide deposit with lead and zinc in 1993 and went on to map, survey, and drill there over several summer seasons. The data from Platinova's detailed geological mapping, together with that gathered from research funded by the Danish Research Councils on resources in the sedimentary basins of North and East Greenland (Kragh, Jensen, and Fougt 1997; Langdahl and Elberling 1997), informed an economic assessment of the exploitation aspects of the sulfide deposit (Van der Stijl and Mosher 1998). Scientific baseline studies were carried out for the environmental impact assessment and, in anticipation of development, the Danish Ministry of Environment and Energy's National Environment Research Institute produced a report assessing the possible environmental impacts of shipping to and from Citronen Fjord (Boertmann 1996). This assessment was cautious, noting that there was little information available at the time on the biological characteristics of the region's marine environment. As no exploitation was then occurring and the size and type of vessels to be used in the eventual transit of mined ore was unknown, it was not possible to determine the likely

effects. The ministry's report did, though, point out the sensitivities and vulnerabilities of the Northeast Greenland marine environment, highlighting key areas of wildlife habitat. It noted that incidental oil spills caused by ruptured tanks probably posed the most serious threat to the environment along the sailing routes to Citronen Fjord, and it recommended that the North East Water polynya (and ice breaking through the ice barriers to the north and south of it) should be avoided. At the beginning of July 1994, a team from the Greenland National Museum in Nuuk visited Citronen Fjord for four days to conduct an archaeological assessment of the area where Platinova was carrying out its exploration and drilling. The survey report described Peary Land as a marginal area and concluded that, despite evidence of past human occupation, there were no major Paleo-Inuit sites in the area that would be affected by Platinova's activities. Indeed, as the report's author concluded, the "character" of the finds were called into question as "archaeological sites" that would have been protected by Greenland's conservation act (Kapel 1994). In describing human settlement in such a remote, marginal area in this way, the history of human dwelling was itself marginalized as not so significant.

Platinova did not move forward with plans for developing the area, but other companies continued to express interest in the resource potential of Citronen Fjord. In December 2016, Greenland's government granted Ironbark a production license to mine three deposits in the area (both open pit and underground mining operations) with an onsite processing facility to produce zinc concentrate for shipment to third party smelters for refining. Impact assessments, including archaeological surveys, have been carried out, and the general impression they leave is that the mine is in such a remote area, with low species diversity and no significant archaeological sites, that the risk of impacts to the environment and wildlife would be minimal and easy to monitor.[1] This runs counter to Ardener's paradox—extracting resources from remote Citronen Fjord will, Ironbark assures, not expose the area to vulnerabilities that cannot be easily monitored and managed. In particular, the environmental impact assessment largely mirrors the shipping assessment done in 1996, but it goes further by judging a shipping accident or marine fuel spill unlikely. Should mineral extraction go ahead—construction and development of infrastructure and ancillary facilities will take two years—lead and zinc ore will be mined year-round and transported by ship through the pack ice of the High Arctic (and will pass near or through the North East Water) to Akureyri, Iceland or another northern European port. An impact benefit agreement aims to ensure employment opportunities for Greenlanders in the project; people from Greenland employed at

the mine will reach it via Pituffik (Thule Air Base), while the plan is for foreign employees to be flown into the operations area from Norway, likely via Station Nord, a military and scientific outpost in northeast Greenland. As of the time of writing this chapter, mine site construction had yet to begin.

In calculating the mineral properties and potential of the Citronen Fjord resource space, geologists, consultants, and company employees draw upon older and more recent subterranean representations, analyze decades of aerial photographs and satellite images, and monitor the latest scientific research on melting sea ice. Bruno Latour's (1987) idea of cycles of accumulation seems apt when reflecting upon the processes by which geological strata and subsurface spaces are explored, measured, described, made legible, and controlled by those involved in projects such as the Ironbark venture. These processes disclose how northern Greenland's shifting topographies are increasingly apparent through diminishing glacial ice, the retreat and thinning of sea ice, thawing permafrost, and coastal erosion. They also assess how these conditions, as well as an intensification of stormy weather, would enable or hinder extraction, mine operations, and shipping. The proponents of the Citronen Base Metal Project and their teams of expert consultants speak in positive terms about how melting—and disappearing—ice would allow for greater possibilities for shipping in and out of the fjord. Excited talk of northern places such as Citronen Fjord emerging as frontier resource spaces fills the offices and meeting rooms of civil servants, geologists, industry consultants, and entrepreneurs in Nuuk. Caught up in this resource talk, northern Greenland is visualized as a dynamic space with stretchable qualities in which mountains, remote fjords, oceanic trenches, ridges, fractures, and fissures are waiting to be explored and their potential as mineral and hydrocarbon reserves assessed (Dodds and Nuttall 2018). Speculation, here, is an observation of potentiality, both in the way that the existence of potential is remarked upon and in the way that facts are constantly produced about it (see Weszkalnys 2015).

Parts of northern Greenland imagined as remote outer edges of the country may be re-spatialized as accessible sites for development and production, but remoteness still matters as a way of framing and legitimizing the marking out of resource zones. The site for the Ironbark mine lies within the Northeast Greenland National Park, which is the largest national park in the world; in company reports and impact assessments, as well as in government discourse, much is made of the site's distance from the nearest Indigenous communities in northwest and east Greenland—to say nothing of the vast spaces of the inland ice that separate it from the capital city. The site very rarely figures

in the conversations I have with friends, scientists, environmentalists, and activists, or even with politicians and business leaders in Nuuk (even though Ironbark and its consultants have organized public information sessions in the capital). This is not to say that some politicians are not excited about the project, or that some members of civil action groups are not worried about it. Mostly, though, other extractive industry projects preoccupy them, such as the mines being scoped out in the Nuuk Fjord region, oil exploration in Davis Strait and Baffin Bay, or the controversies over uranium mining and possible environmental rupture near Narsaq. Citronen Fjord is simply a place beyond the daily lives and geographical imaginaries of most people in Greenland, out of reach to those other than the geologists, survey crews, scientific teams, and members of the Danish navy's Sirius Patrol who venture to what are considered to be the remote northern reaches of the country. This sense of remoteness serves to limit the visibility of the Ironbark project, and pushes it beyond the edges of public interest.

The Ironbark mine illustrates how the making of abstract spaces involves practices and procedures of exploring and mapping subsurface formations, as well as economic calculation that furnishes narratives about the successful operation of extractive industries in Greenland's "far" north. All of this serves to render such spaces as wild zones that can be set aside for resource development projects with a negligible environmental and social impact. Meanwhile, further to the south and west, other extractive projects are being assessed and marked out as possible resource spaces. In Washington Land, for example, Ironbark is exploring the prospects for a base metals project, while seismic surveys to assess possible hydrocarbon reserves have been carried out in Baffin Bay and Melville Bay, in offshore waters close to several small communities that are dependent on hunting and fishing. International companies, as well as Greenland's political authorities and business elites, may see potential arising from deep within mountains and the seabed, but the possibility of extractive industries being developed off of the northwest coast has made many residents of those communities anxious (Nuttall 2016).

## Seismic Surveys, Sustainability, and the Future of Hunting Communities

In recent years, northern Baffin Bay and Melville Bay have been the focus of intense oil exploration. In 2012, a large seismic campaign was carried out in Baffin Bay by several companies. These activities,

composed of four 2D and 3D seismic surveys and shallow core drillings, constituted the most intensive and wide-ranging exploration ever carried out in Greenland. The following year, Shell conducted another series of seismic site surveys, some of which overlapped with a narwhal protection zone in Melville Bay. There are two populations of narwhals that spend the summer in Northwest Greenland: one in Inglefield Bredning, in the Qaanaaq area (estimated at over eight thousand narwhals), the other in Melville Bay (estimated at around six thousand narwhals). Narwhals are caught in Melville Bay by hunters from nearby communities during the open-water season of August and September, the same period when seismic activities can take place. The hunt is regulated by a strict quota system. Following the surveys in 2012 and 2013, hunters from communities in the Upernavik district, as well as from Savissivik in the northwestern corner of Melville Bay, expressed concern that the narwhals were behaving differently when they arrived in the region during their annual migration north. In particular, some felt that the hunt had been influenced negatively due to seismic activities in the area (Nuttall 2016, 2017; Nuttall, Simon, and Zinglersen 2015). Since then, even several years later, local observations have continued to indicate that the narwhals are restless and disturbed, and hunters continue to worry that the effects of the activities from the seismic survey vessels linger. They report that narwhals have been moving closer to the coast and are swimming deeper into ice-choked fjords and inlets, which increases the risk of ice entrapment when the sea eventually freezes in autumn or early winter. Indigenous organizations like the Inuit Circumpolar Council-Greenland, as well as scientists and conservationists, are worried. They have demanded that wildlife and northern coastal ecosystems be protected from oil exploration and shipping—especially given scenarios suggesting rapid depletion of sea ice—as illustrated by the World Wide Fund for Nature's campaign to designate parts of northern Greenland and the Canadian Eastern Arctic as "the Last Ice Area."

Each time I have returned to the Upernavik district in recent years, I have heard people talk of how the seismic activities in northern Baffin Bay and Melville Bay provoke concerns, pressures, and environmental disturbances, as well as hopes that oil development could bring economic benefit. No seismic activities have taken place since 2013, due in the part to the low price of oil and the enormous cost of exploration; the absence of any indication of oil buried deep under Northwest Greenland's ocean floor makes company executives and investors nervous of further exploratory commitment. The oil compa-

nies thus shifted their attention to prospects in waters off Northeast Greenland. While low prices have cast doubt on some exploratory ventures off the northwest coast, hydrocarbon development did not completely disappear from the Greenland government's strategy for nonrenewable resource development. Indeed, bids for a new licensing round for oil and gas exploration in Baffin Bay were invited at the end of 2017. Representatives from the government's resource licensing agencies went to London in May of that year to promote the significance of the area to industry. By the application deadline of 15 December, though, no bids had been received by the Ministry of Resources in Nuuk. Government officials had been hopeful, but the official line they put forward was that the lack of interest indicated restraint by an industry careful of moving forward during a period of low prices. In July 2021, the government suspended the granting of new oil and gas exploration licenses, although several companies still hold existing licenses.

The summertime surveys may be on hold—for the time being, at least—but in the Melville Bay communities of Savissivik and Kullorsuaq, as well as in communities further south in the Upernavik district, hunters have expressed worries that the effects of those recent surveys are still evident, and not just in the ways narwhals are observed to behave, but in the movement of seals away from traditional hunting areas. Hunters also emphasize that the impacts of climate change on their livelihoods have been exacerbated by seismic activities as part of oil exploration campaigns, and many are convinced that the survey vessels will return one day. They are especially worried about the possible impacts on narwhals and other marine life, along with tighter management regulations for narwhal hunting that may be imposed by Greenland's government.

In May 2017, I discussed some of these concerns with hunters in Kangersuatsiaq, a community to the south of Upernavik, and a place in which I first carried out fieldwork in the late 1980s. We talked at length, as we had done on several occasions since 2014, about how the seismic surveys *pikitsippaa* (alarms or agitates) the narwhals. There are also other words used by hunters in Kangersuatsiaq and elsewhere along the northwest coast to describe narwhal behavior since the seismic surveys were conducted. *Katsungaarpoq* refers to how narwhals are restless or in a hurry (the opposite, *katsorpoq*, means to be calm); some narwhals have been described by hunters as *eqqissinngilaq*, which means not to have peace within one's self or not to be left at peace; hunters also observe that narwhals are sometimes confused or perplexed because they are frightened of some-

thing (*uisanguserpoq*). None of these words, they report, were used to describe narwhal behavior before the seismic vessels were operating. Places on land and sea can themselves be agitated, according to local beliefs, just as marine mammals and fish are. Sea ice, for example, can break off and suddenly go adrift because it is agitated and surprised (*siku uippoq*). Hunters say that, following seismic activities, they also noticed ice breaking off to a greater degree in areas close to the coast. In autumn 2019, which was when I was last able to have conversations with hunters about narwhals, other marine mammals and fish, before the COVID-19 pandemic prevented travel for a while to many places beyond Nuuk, this lexicon of agitation, restlessness, confusion, and anxiety remained a rich source for talking about their surroundings.

The kinds of concerns that people in coastal northwest Greenland express over waters that are agitated, sea ice that is surprised, and marine mammals that are anxious in relation to seismic surveys are consistent with how mining activities, oil exploration, and other large-scale industrial development plans have provoked considerable, often fraught political and social debates throughout Greenland. One major concern is with how people feel excluded from participating in meaningful consultation as part of decision-making processes surrounding plans for extractive industry projects, as well as other development schemes such as airports. Thus, much discussion in Northwest Greenland focuses on a desire to see greater emphasis on the inclusion of local knowledge and local observations of change in social and environmental impact assessments (Nuttall 2017).

In response to increasing interest in oil exploration and the development of mines in Northwest Greenland, conservation organizations and environmentalists have sought to designate large parts of the region as exceptional spaces in need of protection. Sea ice, icebergs, and ice shelves, assume value, along with endangered wildlife, as abstractive elements (and as chunks of decay, debris, and detritus in the Anthropocene) that fill and constitute new frontiers of conservation. Northern Greenland is thus represented as either a remote, empty (yet potentially rich) frontier zone and wilderness area, or else a threatened region of ecological uniqueness. In discussions of development and protection, however, local people are rarely consulted. Also excluded, they insist, are the more-than-human entities that configure and animate the world. Local people feel that Indigenous use and knowledge is overlooked in discussions about resource development or environmental protection and in the formulation and implementation of wildlife management. Social and environmental impact

assessments, for instance, do not consider these resource spaces or conservation zones as places of textured and overlapping human–animal–environment interactions, or as constellations of memories, narratives, stories, and possibilities. As a result, they become places separated from society, rather than acknowledged as socio-natural worlds that are constantly in the making. Oil and mineral exploration in Greenland are also implicated in debates about sustainability and the future of hunting and fishing communities in places such as the Upernavik district.

A political discussion about the nature of sustainability and what it means for an extractive economy is playing out in Greenland today. It is being conducted through a set of terms that both refer to and complicate the very idea of sustainability, as well as having implications for life in small communities whose economies are based on hunting and fishing. In wildlife monitoring and management, for example, *nungusaataannngitsumik atuineq* refers to the sustainable exploitation and use of fish or marine mammals; one literal translation goes "to use something in a way that it does not disappear/is not used up/is not wasted." In the time I have spent in hunting and fishing communities in Northwest Greenland and other parts of the country, as well as out at sea or on the ice, I have listened to hunters and fishers talk in similar terms about how marine mammals such as seals and narwhals, as well as land animals such as reindeer and musk ox, should not be used up. To use something is to be aware that it can disappear. Thus, a greedy or disrespectful or unskilled hunter will *nunguppaa* what he goes after; he will "use it all up," "devour it," "finish it." Likewise, in the Upernavik district, the logbooks of hunters and small-scale fishers have revealed a decline in the inshore catch of Greenland halibut, a key species for the local economy. In my discussions with them, they attribute this largely to the quotas granted to larger fishing vessels that sail up the coast from Nuuk, Ilulissat, and other towns. Hunters say of animals and fish that they should "appear all the time at that place [*nungullugit tassuuna nuisarpoq*]" where they can expect to be found, and that the responsibility of a hunter is to make sure that will always be the case. To be a careless hunter, someone who is inconsiderate of the nature of animals and of the needs and lives of other people, is to act in a way that leads to something disappearing. The right kind of hunter, who is in the right kind of relationship with the animals he hunts, is mindful that their actions could lead to a situation where there are no more seals or fish (Nuttall 2019a). Indeed, hunters point out that quota systems

have far-reaching effects in how they disrupt social life and patterns of sharing meat and fish, while also contributing to changes in political and scientific attitudes toward animals and the environment. Recently, scientists at the Greenland Institute of Natural Resources in Nuuk and other research institutes have argued that hunting narwhals is unsustainable and is putting the species at risk of extirpation. They call for targeted conservation but question why hunters should be involved in decision-making and monitoring, as they view their incentive to hunt as being driven purely by commercial interest (Heide-Jørgensen et al. 2020).

In official political discourse, *piujuartitsineq* is the preferred word to convey the notion of sustainability with respect to resource development in Greenland today. *Piuvoq* means something that is useful and that can be used, while *piujuartoq* means something that is lasting. Yet the compound word *piujuartitsineq* is not necessarily applied to the economies of small communities. In a modern Greenland undergoing a process of state formation, hunting appears increasingly irrelevant, and hunting communities, which are often viewed as distant and remote, have become problematic for municipal authorities and self-rule government departments. Geographical remoteness from Nuuk as a centre of distribution and administration makes supply lines and transport expensive and logistically challenging (although, ironically, in March 2020, Premier Kim Kielsen stated in a press conference that he saw remoteness as critical to stemming the spread of COVID-19 in Greenland, making it easier to lock down small communities). Debates over what it is that can be of use for a sustainable economy also invoke things that are no longer useful, including, significantly, small northern communities that depend on hunting and fishing and that many, from the vantage point of Nuuk, see as having an awkward place in a Greenlandic state in the making—distance and remoteness are often equated with "traditional" and "undeveloped," rather than modern and cosmopolitan. Rather, it is geological strata and mineral resources such as rubies, pink sapphires, iron, lead, zinc, uranium, and rare earth elements, as well as oil and gas, that have become central to policies that advance notions of *piujuartitsineq*. Greenlandic politics and the shaping of future Greenlandic society are, to draw on Nick Clark's (2017: 213) phrasing, "implicated with specific geological formations." Potential and possibility emerge from the earth's subterranean depths. Extracted from remote places, it is minerals and hydrocarbons that will make the future possible, not hunting and fishing.

## Conclusions: Deep Time, Extraction, and Greenland's Future in the Blasting

In Greenland today, the technologies and economies of extraction are being formed, shaped, mobilized, and enacted in resource spaces imagined as ontologically distinct from society. These are described as remote and depicted as empty of Indigenous human presence even as they are assembled and constituted as sites of potential, or what David Harvey (2006) calls spaces of global capital, which are nonetheless accessible to the techniques, technologies, and labor necessary for extraction to occur. Such spaces, however, also arise through a process of "accumulation by degradation" (Johnson 2010). Ironically, while rendered as empty of human life, resource spaces are abstracted and animated by political discourses as lively sites of extraction that will provide many of the material conditions for a post-colonial, cosmopolitan, and independent Greenland. The remote and distant are entangled with ideas for a prosperous, globally connected nation. Over the last decade, a representational shift has become apparent in development discourse concerning Greenland's resource potential, from a view of Greenland as a far-flung Arctic territory with a harsh, unforgiving environment that hinders resource exploration and extraction to one of a dynamic, globalized space that is open for business and made increasingly accessible, not just by melting ice but by a governing élite that welcomes oil, gas, and mining companies. However, as the national and municipal elections in April 2021 have shown, not all kinds of mining ventures are necessarily viewed as desirable by all political parties, such as the Kvanefjeld uranium and rare earths project in south Greenland. Greenland's growing tourism sector—an extractive industry in itself—plays with images of a country defined by untouched nature and wildness, a place where adventure awaits the intrepid visitor. It is marketed as remote and distant, yet easily reached by convenient air routes via Copenhagen and Iceland. Accompanying this representational shift is a focus on investment in the technological and engineering expertise that allows (and celebrates) extraction and exploitation in wild regions, with technoscientific inscriptions marking out lands and waters as resource zones that can be mapped, surveyed, tamed, and enclosed, but which still remain at enough of a distance from population centers and vital ecosystems, companies argue, so that social and environmental harm will be minimized. Resources and the spaces within which they are discovered, identified, measured, and dug out are assembled (Li 2014), socially constructed (Bridge 2009), and calculated for their value. They are

formed and abstracted by technocratic practice and political gesture, both of which intimate a negligible impact on environment, animals, and society as a result of development in these zones, as illustrated by plans for extracting iron ore and rare earth elements. The contours of Greenlandic landscapes and the geological strata laid down in deep time underpin geospatial assemblages of resources, which have become a basis for contemporary ideas about sustainability that stretch far into an imagined future (Nuttall 2017).

Today, in addition to mines and hydrocarbon exploration, plans to lengthen runways (and build new passenger terminals) at the airports in Nuuk and Ilulissat to accommodate large international aircraft and boost business and tourism, as well as the construction of Siorarsiorfik, another new suburb of Nuuk that is currently in the planning stage, dominate political and public debate—at least in the capital. The airports and the construction of new residential areas will involve the blasting, excavation, quarrying, transport, and crushing of thousands of tons of rock over the next few years. Blasting for the new airports began during the winter of 2019/20, with the expansion in Nuuk being especially controversial. Opponents organized local campaigns and favored a new airport at a place called Angissunguaq, an island to the southwest of Nuuk, but the government approved the expansion of the existing runway, which lies close to the city, and the construction of a new terminal building (critical for Nuuk's projection of an image as an Arctic metropolis). An airport at Angissunguaq would have allowed for a longer runway and a location that is a safe distance from populated areas, but the government argued that it would have been a far costlier, engineering challenge involving several kilometers of roads, tunnels, and bridges. Reshaping the airport in the city seemed an easier political decision. In October 2019, residents who attended a public meeting with the construction company expressed their concerns over noise, dust, and vibration problems, and with the blasting away and leveling of parts of Quassussuaq (Lille Malene), the mountain below which the existing airport sits. The company's civil engineer tried to reassure them that measures would be put in place to ensure that noise would be minimized—he even pointed out that the explosives used are more environmentally friendly than initially outlined in the project's environmental impact assessment. By February 2020, many people were already feeling exhausted by several weeks of blasting—the hours of explosive activity had been increased, the extent of how much of the mountainside was being leveled was becoming apparent, and construction of a roundabout and a new airport road was adding to the noise and disruption.

Many took to social media or posted comments on newspaper websites to express their anxieties over the prospect of living with two or more years of noise, to say nothing of the disturbance anticipated once the airport is complete and transatlantic aircraft fly in and out of Nuuk. The construction has since become something of a spectacle, with videos posted on YouTube that chronicle the largest blasts and movement of rock and earth. Elsewhere in Nuuk, older apartment blocks built rapidly in the 1960s and 1970s to house people relocated from smaller communities as part of Danish policies of modernization and centralization are also being demolished, mainly because of structural and environmental health concerns (although this also represents a gradual erasure of buildings that are symbols of those policies and the social problems that resulted, as well as being a material reminder of colonial trauma). Whether it is the underwater sonic boom from seismic surveys in Melville Bay, the blasting of explosives in Nuuk for airport construction, or wrecking balls pounding on concrete walls, noise is an increasingly constant and unruly accomplice to Greenlandic future-making.

The anticipatory politics concerning a future Greenland in a new Arctic play out in Nuuk and geopolitics, geo-economics, geophysics, urbanization, and environmental change, as well as blasting and digging make their co-presence increasingly felt in sensorial and embodied ways (Dodds and Nuttall 2019). City planners imagine an urban, Arctic metropolis, spreading around headlands and inlets with greater global connectivity, attractiveness, and liveability, which could have a population of thirty thousand within the next couple of decades. Many of these new residents are anticipated to be from communities such as those in the Upernavik area and other "outlying" districts in north, south, and east Greenland. Yet viewed from Denmark, other parts of Europe and North America, Nuuk is a place on the edge—an Arctic frontier for construction companies and architects who see possibilities for lucrative contracts and being celebrated globally for award-winning design in the outer reaches of the Danish Realm. One example is Anstalten Correctional Facility, the new prison in Nuuk. This description appears on the homepage of the Danish architects who designed it:

> Nestled in the rugged terrain of Greenland's seaside capital, Anstalten in Nuuk—a new correctional facility, is the setting for progressive rehabilitation, and a bold statement about the power of architecture to affect human behavior. Openness, light, views, security and flexibility are the leading values behind the design of the first such facility in the capital of

> Greenland. The project matches the unique and beautiful surroundings and supports the focus of the Danish Prison Service on both punishment and rehabilitation.[2]

The company's website goes on to describe how, architecturally, the prison is "composed of accurately shaped blocks, which in their positioning follow the contours of the rocky landscape" while "burnt sienna corten steel facades, impacted by the local climactic conditions, complement the surrounding landscape." Openness is a central theme—large windows not only let in light, but "draw nature inside." Overall, the building is designed and situated to "appear subordinate to its surroundings." Such description brings to mind Jean Baudrillard's (1996) notion of atmospheric values in accounting for the design of buildings. The materials used to construct the prison, and which are intended to support punishment and rehabilitation, blend with the land, sea and sky. Concrete, steel, wood, and glass draw their meaning from the Arctic environment. But in the sense that Baudrillard suggests, they have an abstractness making possible "a universal play of associations among materials, and hence a transcendence of the formal antithesis between natural and artificial materials" (Baudrillard 1996: 39). Building materials, as well as colors, volume, space, light, views towards the sea, and walls decorated with animal motifs from Greenlandic stories and oral history intermingle and are used as atmospheric elements.

For Ardener (1987) remote areas are also full of innovators and can experience a sequence of innovations that appears endless—there is always something new to build, another pier, harbor, or housing district, for example, or another quarry to develop, another road to push through, and airports to construct. This is apparent in contemporary Nuuk as a center for abstraction. But it is also a place where the "boundless possibilities" of "abstract integration" (Baudrillard 1996: 40–41) make it an attractive site for innovation. Innovators, whether they are architects, urban designers, fishing company executives, mining engineers, resource managers, or policy makers, are essential to the historical and contemporary processes of spatial, social, and cultural transformation, as well as the materialization of atmosphere and affect, that have invented and continue to reinvent Greenlandic towns, settlements and the country's remote, wild edges as zones of possibility and opportunity. So, while mining may be seen as one critical pillar of Greenland's economic development policy, and while some politicians remain hopeful that oil may flow one day, the building of transport infrastructure and the design of urban spaces for

a new, emergent Greenland, whose people from its outer edges are compressed into an ever-growing capital, are no less predicated on the extraction, removal, leveling, crushing, fashioning, and shaping of ancient rock.

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## Notes

1. "Citronen Base Metal Project Environmental Impact Assessment," Vol. 1. Prepared by Ironbark Zinc Limited and Orbicon A/S, July 2016.
2. Schmidt Hammer Lassen Architects, https://www.shl.dk/anstalten-correctional-facility/. Accessed 15 March 2021.

## References

Appel, Hannah, Arthur Mason, and Michael Watts, eds. 2015. *Subterranean Estates: Life Worlds of Oil and Gas*. Ithaca: Cornell University Press.

Ardener, Edwin. 1987. "Remote Areas: Some Theoretical Considerations." In *Anthropology at Home*, edited by Anthony Jackson, 38–54. London: Tavistock.

Årthun, M., T. Eldevik, L. H. Smedsrud, Ø. Skagseth, and R. B. Ingvaldsen. 2012. "Quantifying the Influence of Atlantic Heat on Barents Sea Ice Variability and Retreat." *Journal of Climate* 25(13): 4736–43.

Baudrillard, Jean. 1996. *The System of Objects*. London: Verso.

Bergmann, Linda S. 1993. "Woman against a Background of White: The Representation of Self and Nature in Women's Arctic Narratives." *American Studies* 34(2): 53–68.

Boertmann, David. 1996. *Environmental Impacts of Shipping to and from Citronen Fjord: A Preliminary Assessment*. NERI Technical Report, no. 162. Roskilde: National Environmental Research Institute.

Box, Jason E., and David T. Decker. 2011. "Greenland Marine-Terminating Glacier Area Changes: 2000–2010." *Annals of Glaciology* 52(59): 91–98.

Bridge, Gavin. 2009. "Material Worlds: Natural Resources, Resource Geography, and the Material Economy." *Geography Compass* 3(3): 1217–44.

Carlson, William A. 1940. *Greenland Lies North*. New York: Macmillan.

Clark, Nick. 2017. "Politics of Strata." *Theory, Culture and Society* 34(2–3): 211–31.

Cons, Jason, and Michael Eilenberg. 2019. "Introduction: On the New Politics of Margins in Asia: Mapping Frontier Assemblages." In *Frontier Assemblages: The Emergent Politics of Resource Frontiers in Asia*, edited by Jason Cons and Michael Eilenberg, (XX). Chichester: John Wiley and Sons Ltd.

De Gregori, Thomas R. 1987. "Resources Are Not; They Become: An Institutional Theory." *Journal of Economic Issues* 21(3): 1241–63.

Dodds, Klaus, and Mark Nuttall. 2018. "Materialising Greenland within a Critical Arctic Geopolitics." In *Greenland and the International Relations of a Changing Arctic: Postcolonial Paradiplomacy between High and Low Politics*, edited by Kristian Søby Kristensen, and Jon Rahbek-Clemmensen, 139–54. New York: Routledge.

———. 2019. "Geo-Assembling Narratives of Sustainability in Greenland." In *The Politics of Sustainability in the Arctic: Reconfiguring Identity, Space and Time*, edited by Ulrik Pram Gad and Jeppe Strandsbjerg, 224–41. New York: Routledge.

Geikie, James. 1874. *The Great Ice Age and its Relation to the Antiquity of Man*. London: W. Isbister.

Harvey, David. 2006. *Spaces of Global Capitalism: Towards a Theory of Uneven Geographical Development*. London: Verso.

Hastrup, Kirsten. 2018. "A History of Climate Change: Inughuit Responses to Changing Ice Conditions in North-West Greenland." *Climatic Change 151: 67–78*.

Heide-Jørgensen, Mads-Peter, Eva Garde, Rikke Guldborg Hansen, Outi M. Tervo, Mikkel-Holger S. Sinding, Lars Witting, Marianne Marcoux, Cortney Watt, Kit M. Kovacs, and Randall R. Reeves, "Narwhals Require Targeted Conservation." *Science* 370(6515): 416. https://www.doi.org/10.1126/science.abe7105.

Hill, Jen. 2008. *White Horizon: The Arctic in the Nineteenth-Century British Imagination*. Albany: State University of New York Press.

Johnson, Leigh. 2010. "The Fearful Symmetry of Arctic Climate Change: Accumulation by Degradation." *Environment and Planning D* 28(5): 828–47.

Kapel, Hans. 1994. *Citronen Fjord, Nord Grønland: Arkæologisk recognescering i forbindelese råstofefterforskning i det nordøstlige Peary Land, sommeren 1994*. Report. Nuuk: Greenland National Museum and Archives.

Kragh, Karsten, Svend Monrad Jensen, and Henrik Fougt. 1997. "Ore Geological Studies of the Citronen Fjord Zinc Deposit, North Greenland: Project 'Re-

sources of the Sedimentary Basins of North and East Greenland.'" *Geology of Greenland Survey Bulletin* 176: 44–49.

Langdahl, Bjarne R., and Bo Elberling. 1997. "The Role of Bacteria in Degradation of Exposed Massive Sulphides at Citronen Fjord, North Greenland: Project 'Resources of the Sedimentary Basins of North and East Greenland.'" *Geology of Greenland Survey Bulletin* 176: 39–43.

Latour, Bruno. 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press.

Li, Tania Murray. 2014. "What is Land? Assembling a Resource for Global Investment." *Transactions of the Institute for British Geographers* 39(4): 589–602.

Nuttall, Mark. 2012. "Imagining and Governing the Greenlandic Resource Frontier." *The Polar Journal* 2(1): 113–24.

———. 2013. "Zero-Tolerance, Uranium and Greenland's Mining Future." *The Polar Journal* 3(2): 368–83.

———. 2016. "Narwhal Hunters, Seismic Surveys and the Middle Ice: Monitoring Environmental Change in Greenland's Melville Bay." In *Anthropology and Climate Change: From Actions to Transformations*, edited by Susan A. Crate and Mark Nuttall, 354–72. New York: Routledge.

———. 2017. *Climate, Society, and Subsurface Politics in Greenland: Under the Great Ice*. New York: Routledge.

———. 2019a. "Sea Ice, Climate and Resources: The Changing Nature of Hunting along Northwest Greenland's Coast." In *Climate, Capitalism and Communities: An Anthropology of Environmental Overheating*, edited by Astrid B. Stensrud and Thomas Hylland Eriksen, 57–75. London: Pluto Press.

———. 2019b. "Icy, Watery, Liquescent: Sensing and Feeling Climate Change on Northwest Greenland's Coast." *Journal of Northern Studies* 14(2): 71–91.

Nuttall, Mark, Malene Simon, and Karl Zinglersen. 2015. "Possible Effects of Seismic Activities on the Narwhal Hunt in Melville Bay, Northwest Greenland." Nuuk: Greenland Climate Research Centre/Greenland Institute of Natural Resources.

Orban, Clara E. 1997. *The Culture of Fragments. Words and Images in Futurism and Surrealism*. Amsterdam: Editions Rodopi.

Polyakov, Igor V. et al. 2017. "Greater Role for Atlantic Inflows on Sea Ice Loss in the Eurasian Basin of the Arctic Ocean." *Science* 356(6335): 285–91.

Rasmussen, Knud. 1921. *Greenland by the Polar Sea*. New York: Frederick A. Stokes Company.

Ryan, Jonathan C., Alun Hubbard, Marek Stibal, Tristram D. Irvine-Fynn, Joseph Cook, Laurence C. Smith, Karen Cameron, and Jason Box. 2018. "Dark Zone of the Greenland Ice Sheet Controlled by Distributed Biologically Active Impurities." *Nature Communications* 9: 1065. https://doi.org/10.1038/s41467-018-03353-2.

Saxer, Martin, and Ruben Andersson. 2019. "The Return of Remoteness: Insecurity, Isolation and Connectivity in the New World Disorder." *Social Anthropology* 27(2): 140–55.

Shoard, Marion. 2000. "Edgelands of Promise." *Landscapes* 1(2): 74–93.

Sorge, Ernst. 1935. *With Plane, Boat, and Camera in Greenland: An Account of the Universal Dr. Fanck Greenland Expedition*. London: Hurst & Blackett Ltd.

Stroeve, Julienne C., Mark C. Serreze, Marika M. Holland, Jennifer E. Kay, James Malanik, and Andrew P. Barrett. 2012. "The Arctic's Rapidly Shrinking Sea Ice Cover: A Research Synthesis." *Climatic Change* 110(3–4): 1005–27.

Van der Stijl, Frank W., and Greg Z. Mosher. 1998. "The Citronen Fjord Massive Sulphide Deposit, Peary Land, North Greenland: Discovery, Stratigraphy, Mineralization, and Structural Setting." *Geology of Greenland Survey Bulletin* 179. Copenhagen: Geological Survey of Denmark and Greenland.

Wadhams, Peter. 2012. "Arctic Sea Ice Cover, Ice Thickness, and Tipping Points." *AMBIO* 41: 23–33.

———. 2016. *A Farewell to Ice. A Report From the Arctic*. London: Penguin.

Wang, Muyin, and James E. Overland. 2009. "A Sea Ice Free Summer Arctic within Thirty Years?" *Geophysical Research Letters* 36(7): L07502.

Watts, Michael J. 2015. "Securing Oil: Frontiers, Risk, and Spaces of Accumulated Insecurity." In *Subterranean Estates: Life Worlds of Oil and Gas*, edited by Hannah Appel, Arthur Mason, and Michael Watts, 211–36. Ithaca: Cornell University Press.

Weszkalnys, Gisa. 2015. "Geology, Potentiality, Speculation: On the Indeterminacy of First Oil." *Cultural Anthropology* 30(4): 611–39.

Whitehead, Alfred North. (1920) 2007. *The Concept of Nature*. New York: Cosimo.

Wilkinson, Jeremy, and Julienne Stroeve. 2018. "Polar Sea Ice as a Barometer and Driver of Change." In *The Routledge Handbook of the Polar Regions*, edited by Mark Nuttall, Torben R. Christensen, and Martin J. Siegert, 176–84. New York: Routledge.

Zimmermann, Erich W. 1951. *World Resources and Industries: A Functional Appraisal of the Availability of Agricultural and Industrial Resources*, 2nd ed. New York: Harper and Brothers.

CHAPTER 5

# Forging Off-World Frontiers

## *Chinese Steel and Arctic Iron*

Mia M. Bennett

In August 2019 above the Arctic Circle in Kiruna, Sweden, I sought shelter from the rain by plunging half a kilometer beneath the boreal forest floor. Deep in the underbelly of the Swedish Arctic, I was touring the tunnels and shafts of the LKAB underground iron ore mine, the world's largest, and interviewing a manager regarding recent transformations to the global steel industry. The Indigenous Sámi people used to drag ore from the mine with their reindeer, but now—after nearly a trillion tons of ore have been dug out of earth (Figure 5.1)—decisions on industrial and environmental policy as far away as Beijing are affecting LKAB's operations. Explaining a recent rise in iron ore prices, the manager remarked, "The Chinese authorities decided that Chinese people should be able to see blue sky." The government's effort to clean up its domestic steelmaking industry by relying on higher-grade ores (60–67 percent Fe) had pushed up the price for so-called fines, benefiting producers even if they don't directly export to China, as is the case with Kiruna.

While iron ore and steel sectors were nationally or regionally integrated at the start of the twentieth century, today, they are globally integrated. Between 2000 and 2017, annual global production of crude steel more than doubled to 1.7 billion tons (World Steel Association 2018). This increase was largely driven by increased Chinese manufacturing to meet domestic demand spurred by an urban construction boom. Over the past two decades, China's nearly 10 percent annual economic growth rate has led the country to nearly recover its position

as the world's preeminent economy, a status it held for two millennia prior to 1820 (Maddison 2007). In step with its reascendance, China has become the world's largest importer of iron ore and exporter of the alloy in which it is a key component: steel.

The global iron ore and steel industries are inseparable from each other. When one expands, the other does, too. The rapid growth of these two sectors in China has depleted relatively proximate stores of iron ore in places like Australia at the same time as domestic demand for steel has slowed. As a result, the Chinese state and companies are looking farther afield for both sources of iron ore imports and markets for steel exports. Distant resource frontiers like the Arctic, which has rich iron deposits in places like Greenland, Canada, and Fennoscandia, are attracting attention from Chinese investors and importers.

China's polar activities are typically seen in terms of its interest in scientific research, natural resources, shipping, and governance (Hong 2012; Jakobsen and Lee 2013; Lanteigne 2017; Rainwater 2013; Solli, Wilson Rowe, and Yennie Lindgren 2013; Stepien 2017). The Chinese government's official Arctic Policy, published in 2018 (State Council Information Office 2018), lists many of these activities as reasons for China's interest in the Arctic. Yet little work has explored the ways in which China's metallurgical demands motivate its northern pursuits. While natural resources feature prominently in analyses of Beijing's participation in polar development, they tend to be discussed in the abstract, without fine-grained consideration of the ores and fuels powering Chinese economic growth. This substantial omission reflects the fact that previously, the country's appetite for everything from iron ore to rare earth metals was omitted from broader explanations of the country's economic rise (McKay, Sheng, and Song 2010). Yet recent examinations of the geopolitical and economic impacts of China's resource demands (Economy and Levi 2014; Klinger 2017; Lee 2017) should inspire a more materially sensitive analysis of China's Arctic activities. Research that takes substances seriously and acknowledges that "matter matters" (Ingold 2007) can elucidate how the country's globe-spanning iron and steel industries are restructuring social and ecological processes in the North while reproducing the region's economic marginalization, providing a more relational perspective on the consequences of the scale of China's resource demands.

This chapter starts from the premise that the iron and steel industries constitute generative sectors: industries whose expansion is articulated through the reconfiguration of the capitalist world-economy in a way that benefits the ascendant country (Ciccantell and Bunker

2004). To ensure continued economic growth, national governments must coordinate the heavy industry and transport sectors. Countries that rose to primacy during the industrial era—from Holland to Great Britain, the United States, and Japan—altered the spatial and material logics of the world-economy to support their own rise (Bunker and Ciccantell 2003). Steelmaking formed an important engine for these countries' industrialization processes, and iron-poor countries like Britain and Japan imported the commodity from nearby countries to supply their steel mills. Today, the iron-clad reverberations of the rise of China, with its 1.4 billion people, are incorporating even more remote locations into the country's economic networks.

Whereas Paul Ciccantell and David Smith examine global commodity chains by starting "at the beginning" (2009: 379), this chapter reverses the typical direction of analysis. China's economic growth and its consequences are first examined from the outer edges of its resource frontiers—specifically the Arctic—rather than from within the country's borders. As the chapter's title suggests, the analysis also takes a more expansive and relational approach than is typical of global commodity chain research. The case study of the Arctic is used to explicate how the scale of China's economy is spurring the extraction of resources and the development of infrastructure in ever more remote locations—areas that can be considered "off-world," referencing a term from the 1982 science fiction film, *Blade Runner*. The concept refers to planets that promise opportunities long since evaporated from an exhausted, polluted Earth. I expand the off-world to comprise both remote and virtual areas from which value can be extracted, ranging from the Arctic to financial markets to, perhaps in the future, outer space.

By rationalizing its generative sectors and advancing new technologies, standards, and mechanisms, China is strengthening its global economic position. At the same time, in anticipation of seemingly insatiable Chinese demand, resource frontiers are proactively investing in new infrastructure and mineral deposits. While mining locales deepen their dependence on iron ore extraction at larger, riskier scales, China externalizes the risks of its generative sectors through the prolongation and financialization of commodity chains. The country is also enclosing new areas and dimensions for extraction beyond the polar regions, from the deep sea to cyberspace and outer space. These four spaces comprise the "strategic new frontiers" (战略新疆域), which its National Security Law was widened to cover in 2015 (Andersson 2021; Liu 2018). The government's discursive linking of the terrestrial, virtual, and celestial realms suggests that theories of

**Figure 5.1.** | *The Kiruna iron ore mine in northern Sweden, 2019.*


the country's ascendance may require a more multidimensional scope and scale that encompasses and potentially even transcends planet Earth.

To explore these material and abstract processes, this chapter examines China's rise in the Arctic through its rapidly expanding iron and steel industries. Four vignettes illustrate the following: first, the capacity of China's generative sectors to operate at an unprecedented scale; second, the anticipatory dynamics of iron ore production; third, the country's role in Arctic infrastructure development; and fourth, China's enactment of environmental and financial measures that externalize the negative material impacts of the iron and steel sectors to the off-world—a place that is increasingly out of sight, out of mind.

## Generating a Frontier of Scale

For a country like China whose economy still hinges on the conversion of raw materials into industrial outputs, accessing resources is critical for continued growth. As nearby resources become depleted over time, the ascendant state pursues policy and technical solutions to reduce transport costs in order to access more distant commodities. In this sense, achieving economies of scale is key to facilitating the national

accumulation of bulk goods like iron ore. When Japan's postwar economy began accelerating, its trade missions were directly responsible for opening up Australia's Pilbara region to iron ore production in the 1960s and Brazil in the 1980s (Siddique 2009). Since iron ore mining has high barriers to entry due to the extensive infrastructure needed to bring bulk goods to market, both new projects ("greenfields") and the expansion of existing sites ("brownfields") require sizeable injections of capital, often from governments or state-owned enterprises, which are aimed at achieving decreases in transport costs.

Paradoxically, over time these developments worsen "the very contradiction between scale and space that they are designed to solve" (Ciccantell and Bunker 2004: 569). The ascendant country's mounting ability to import resources from ever more distant locales impacts resource peripheries, especially those that export raw materials (Ciccantell and Bunker 2004: 570). In the case of iron ore, the ferrous mineral is namely located in Australia, Brazil, Canada, Russia, the United States, India, and North Africa.

Like Japan, China's chief iron ore supplier is Australia, which provides 62 percent of its imports. This dominance is due to the continent's proximity and ample resources, along with the infrastructure already in place after half a century of Japan–Australia trade. Brazil, where iron ore began to be developed also thanks to Japanese efforts, provides 31 percent of China's supplies. China's ongoing quest to secure and expand Asia–Brazil iron ore trade demonstrates that once more proximate supplies are exhausted, global supply chains penetrate more distant resource frontiers. The South American country's centrality to global iron ore supplies has been facilitated by an expansion in tanker size, which Chinese shipbuilding companies have helped advance. For iron ore to be shipped competitively from the east coast of the Americas across the Atlantic and Indian Oceans to China, vessel capacity must be roughly three times larger.

The rise of China's iron and steel industries resembles the articulation of generative sectors in Japan and South Korea. However, China's growth is more dramatically restructuring the global economy due to the country's scale. While Japan's economy is large, its population is only 10 percent of China's. Consequently, Japan's generative sectors have not set in motion the opening of remote resource frontiers to the same degree as China's. In recent years, China has accounted for 70 percent of annual global iron ore imports. Japan, in second place, accounts for a mere 7.5 percent of imports. When it comes to growth in the market, China's dominance is even more apparent. Over the past fifteen years, the global iron ore trade increased by 1,020 megatons

(Mt). Of this increase, 94 percent (950 Mt) found its way to China. As China's iron ore demands outpace those of other countries, its ability to set the global price of iron ore rises, too, reflecting its growing dominance of the industry.

To amplify the reach of its generative sectors, the Chinese government has undertaken activities such as constructing ocean-going vessels of record-breaking size, investing in distant iron ore bodies to diversify the country's sources of imports, and consolidating the nation's steel mills to enhance their purchasing power. Illustrating the expansion of the Chinese iron industry, in September 2017, state-owned Qingdao Beihai Shipbuilding Heavy Industry launched *Ore Tianjin,* the world's largest ore carrier, to deliver iron from Brazil, over twenty thousand kilometers away. The 400,000-ton, Hong Kong–flagged Valemax ship (a category of vessels that deliver iron ore to Europe and Asia via the Atlantic and Indian Oceans and that are owned by Brazilian mining company Vale) was unveiled in Qingdao, the most important discharging port for iron ore carriers in northern China. Qingdao and two other ports in China's northeast import more than half of the country's iron thanks to their proximity to Chinese steel mills. These were built in the 1970s near the country's primary iron deposits in the Precambrian rocks of the North China Craton geological formation (Zhao and Guo 2012), which coincidentally centers on Beijing. The proximity of steel mills to Beijing is worth noting, for as this chapter later will explore, residents' demands for cleaner air are spurring the central government to improve air quality around the capital. In turn, this environmental initiative is pushing up Chinese demand for fines, which can be found in the Arctic in locations like Kiruna (northern Sweden), Baffin Island (Canada), and Greenland.

*Ore Tianjin* is an exercise in superlatives: its endurance range allows it to sail for up to 47,000 kilometers—a little over four times around the world—and its deck is the size of three football fields. A Valemax ship, it is too large to fit through the Panama or Suez Canals, so it must sail via the Cape of Good Hope or Cape Horn. The vessel fulfills the first of thirty orders for very large ore carriers (VLOCs) placed by three Chinese shipping lines in 2016: China Ocean Shipping Company, China Merchants Energy Shipping, and ICBC Leasing. Each of these companies has signed a twenty-seven-year contract of affreightment with Vale to purchase sixteen million tons of iron ore annually. As of 2021, at least twenty-six of the VLOCs have been built, helping to rapidly expand the capacity and reach of China's iron ore sector.[1] Much of the expansion of China's shipbuilding industry—now the world's largest, accounting for 36 percent of the global market—has

come not through the development of cutting-edge technology, at which countries like Japan and South Korea still excel. Instead, China's shipbuilding successes can largely be attributed to government subsidies which allow Chinese companies to offer rates lower than any competitor (Jiang, Bastiansen, and Strandenes 2013). The same can also be said of the Chinese steel industry, which is not as high-tech as Japan's and South Korea's and rather depends on state subsidies to be competitive.

*Ore Tianjin* will provide China with iron ore from Brazil, but bulk carriers are starting to call in the Arctic, too. Over the past decade, China's iron and steel commodity chains have gradually been extending into this iron-rich region. In 2010, the Hong Kong–flagged, ice-class *MV Nordic Barents* sailed from Kirkenes, Norway carrying 40,000 tons of iron ore to China via the Northern Sea Route. The voyage marked the first international transit via Russia's northern coastline. The ore came from the Sydvaranger Gruve mine, which originally opened in 1910 to supply Germany, approximately 2500 km away by boat. The first ship laden with ore from the mine, which sank, was carrying 2,000 tons of the rusty black rocks—just 5 percent of *Ore Tianjin*'s capacity, which, exactly a century later, this vessel sailed ~12,000 km to reach its destination.

The Sydvaranger Gruve mine is located within the Fennoscandian Shield, a geological formation where archaeological traces of iron furnaces have been dated to 1,000–800 BCE (Lavento 1999). This is Europe's largest exposed area of Precambrian shield, which is the same type of geological formation characterized by high iron concentrations located around Beijing. Though the world's most important sources of iron ore are the high-grade hematite bodies contained in Precambrian formations in Australia, Brazil, India, and South Africa, the exhaustion of these supplies means that iron ore mines in more remote regions like the Arctic are being reoriented to supply China. Previously, Fennoscandian mines like Sydvaranger Gruve and Kiruna largely supplied European markets such as Germany and the United Kingdom (and the United States to a degree, too) (Carlson 1952). Now, thanks to innovations in shipping, a gradual lowering of transportation costs, and increasing demand for high-grade iron ore, it is feasible for peripheral production sites to meet demand for minerals tens of thousands of kilometers away. China is thus arguably distinct from previous ascendant economies in that its government is able to coordinate not only the opening of new resource frontiers, but rather an entirely new frontier of scale.

## Banking on China: Anticipating Infinity

Compared to the development of other countries' generative sectors, China's rapid economic ascendance is provoking heightened speculation. This anticipation of the "specter of China," to borrow from C. K. Lee (2017), is extending the country's influence into new resource frontiers without it necessarily even being present. In other words, anticipation of the scale of China's demand is so high that it is compelling activities in extractive frontiers before Chinese developers even arrive.

Conventional assumptions would hold that for China to access Arctic iron ore, the country must sponsor the development of new resources. Following this logic, in 2005, the Chinese central government's Iron and Steel Industry Development Policy encouraged steel firms to invest in overseas iron ore projects with the support of concessionary loans from state-backed banks. This policy was aimed at reducing the global monopoly on production held by the "Big Three" iron ore miners: Vale, based in Brazil; and Rio Tinto and BHP Billiton, based in Australia (Wilson 2012). In line with this effort, in 2014, Chinese company General Nice obtained the rights to Greenland's Isua iron ore mine from bankrupt British company London Mining PLC, though in 2021, the Greenlandic Government revoked its license.

Yet at the same time that China seeks to invest in foreign mining projects, Arctic governments are proactively building infrastructure to attract Chinese vessels and investors without guarantees. Whereas an Australian trade mission to Japan in 1962 resulted in an official Japanese visit to the Pilbara region in 1964 and the subsequent signing of numerous iron ore deals, in certain parts of the Arctic and sub-Arctic, efforts to develop mineral resources are happening without Beijing's direct involvement. Some of this speculative investment stems from the fact that the high grade of many Arctic iron ore deposits allows operators to command a higher price that makes transportation across long distances economically viable. Ultimately, however, Arctic iron ore mines remain at the whim of global commodity cycles increasingly determined by shifts within China given its market dominance, even when these mines do not export their ores to China. Moreover, their position may be even more precarious than more conventional iron ore mines given their distance to market.

One northern iron ore district investing in infrastructure and mining operations in the hopes of attracting China is the one-thousand-kilometer-long Labrador Trough running between Quebec and Lab-

rador in Canada. Here, in Canada's iron belt, decades of boom-and-bust cycles compounded by the traumas of colonialism have wreaked havoc on local Indigenous peoples and scarred their homelands (Boutet 2015). Riding on the 2000s commodities wave, in October 2013, the first Chinamax vessel ever to be loaded in North America departed from the Port de Sept-Îles with three hundred thousand tons of high-grade iron ore concentrate from the nearby Bloom Lake mine. In defiance of the region's turbulent economic history, the president and CEO of the Port de Sept-Îles (2013) declared, "We are witnessing a historical turning point today: the opening of our Port to the next generation of ore vessels of the planet." Yet in fact, "planet" is effectively synonymous with "China," which receives 98 percent of its iron ore imports by ship (Sand 2013). China's dominance of extraction not only allows it to dominate the market. It also enables the country it to set new standards at global scales at which it has a nearly exclusive ability to operate.

When the first Chinamax vessel was loaded, Bloom Lake Mine was 75 percent owned by the Montreal-based Consolidated Thompson Iron Mines and 25 percent by Wuhan Iron and Steel Corporation (Jorgenson 2010). Known by its acronym, WISCO, the Chinese state-owned enterprise is described as "the first ultra-large integrated iron and steel company established under the People's Republic of China" (Century Global Commodities 2018). WISCO plans to increase its annual steel production from forty million to sixty million tons: nearly three-quarters of the amount of steel that the entire United States produced in 2017. The vertically integrated Chinese state-owned enterprise has stakes in several other companies operating in the Labrador Trough (Van de Kletersteeg 2012), including a $14 billion iron ore mining project at Lac Otelnuk. In a 2015 feasibility study for the project, between 80 and 100 percent of exports were modeled as going to China (Risto et al. 2015).

Yet just two years after the Port de Sept-Îles's CEO announced a "historical turning point," iron ore prices collapsed. This event was a painful reminder that even growth led by China, despite its billion-plus consumers, is both finite and volatile. Significant structural changes to the nature of contracts between iron ore buyers and sellers in 2009 involving a switch from yearly negotiations that set benchmark prices to selling iron ore at spot prices set by real-time interactions between buyers and sellers further exacerbated market volatility, too. The impacts of the 2015 collapse in iron ore prices were also more widespread than previous market busts, for as more Indigenous peoples take up mining jobs, they become more vulnerable to global com-

modity cycles. Comparing the 2015 crash with the previous one in the 1980s, the lands and resources officer for the Uashat reserve next to Sept-Îles remarked to a Canadian newspaper: "In the past we were set aside of the economy. We were not included and we were not allowed to be part of it. . . . We just saw the city going down, but we were already down at the time. . . . This is probably the first generation of Innus that are really impacted by recession. That's really new for us" (Van der Linde 2016).

While the Bloom Lake mine, its associated claims, and the railway were sold for $4.9 billion in 2011, a drop in iron prices forced its sale to Australia-based Champion Iron Ore for a mere $10.5 million in 2015—just months after London Mining PLC, also bankrupted by the drop in prices, transferred its rights to Greenland's Isua mine to General Nice. The president of the Sept-Îles economic development committee lamented: "I can't say that it's not worrying, but I wanted to show this is happening on an international scale, so it's not about just our region, and we have to adapt" (Van der Linde 2016). In order to try to catch up to commodity cycles in 2012, when ore prices were high, the Canadian government approved the modernization of a new deep-water dock with two ship loaders and conveyor lines at the Port of Sept-Îles. Investments totaling $220 million were drawn from the Canadian government's Gateway and Border Crossings Fund and from potential end users, namely iron ore companies. A press release from the Government of Canada (2014) noted that the port's modernization "will help the port meet global shipping standards for the iron ore industry, which is the largest commodity shipped through the port to overseas markets." Though described as "global," these standards, scales, and logistics are once again set by China. The Port de Sept-Îles's newly constructed multiuser dock was specially designed to accommodate 400,000 deadweight ton (DWT) Chinamax ships—the only such port in North America that can do so.

By the time the port's upgrades were finished, iron ore prices had recovered from their 2015 lows. In March 2018, *MV Magnus Oldendorff* departed from the new dock—the first large bulk carrier to do so—bound for Qingdao with 190,000 tons of Bloom Lake iron ore. The mine required CAD $350 million to restart production, which was raised from the Quebec government, a pension fund tied to the price of iron ore, and a Canadian mining financier, Sprott Resource Lending. In a newspaper interview, the chief operating officer of Quebec Iron Ore, the mine's operator, reflected: "It's never easy to raise $350 million to start a project, but people believed in the potential of the iron mine at Bloom Lake" (Marowits 2017). Bloom Lake lived to see

another day, but only by taking on risks at a bigger scale—jeopardizing the security of not only local residents and Indigenous peoples but the savings of Quebecois pensioners farther away, too.

Already, Canada is littered with ten thousand abandoned mines (Mayes et al. 2009). Australia, another mining frontier, has some fifty thousand obsolete sites (Unger et al. 2012). As governments in places like Canada reconfigure their national infrastructure to fit like puzzle pieces into China's burgeoning generative sectors and integrate previously marginalized populations into production processes, the risks of environmental and socioeconomic destruction grow. With global iron ore chains extending into more distant locales like Baffin Island and the Amazon rainforest, the likelihood of careful closures and cleanups is becoming even more remote. Indeed, the rumored reason for the Bloom Lake Mine's sale for a pittance in 2015 was that it allowed the operator to dodge $650–700 million in closure costs (Zernov 2015). That same year, one of Vale's iron ore tailings dams in Brazil collapsed, sending a surge of toxic waste that killed nineteen people and destroyed hundreds of homes. In 2019, an even larger collapse occurred, causing 270 people to lose their lives. The upscaling of iron ore mining promises big returns. But it portends unprecedented disasters, too.

## Offshoring to the Off-World

China imports iron ore largely to supply its massive steel industry. In 1949, when the People's Republic of China was established, the country produced 158,000 tons of steel (Feng 1994). In 2017, it produced 831.7 million tons. Much of the rationalization and rapid growth of China's steel industry can be traced to the turn of the twenty-first century, in step with the country's wider push to urbanize, develop, and invest overseas. In 1996, China surpassed Japan to become the world's largest steel manufacturer (Wu 2000). Then, in 2000, Beijing began rationalizing production by closing overproducing, unprofitable steel mills, referred to as "zombie companies" in English-language Chinese state media reports (Du 2016). The government has also encouraged steel producers to construct new mills along the coast to lower transportation costs associated with the import of raw materials and the export of manufactured steel. By 2020, although production in much of the world slowed down due to the COVID-19 pandemic, Chinese steelmaking continued to rise, accounting for 56.5 percent of global steel production.

As with China's iron ore imports, the growth of its steel manufacturing sector can be explained by its formerly low level of per capita steel use paired with its large population. Whereas China's steel intensity in 2000 was a little over 100 kg per capita, Hong Kong and Taiwan's were, respectively, above 800 kg and 900 kg (Kirk 2004). By 2016, Chinese steel consumption reached 506 kg per person per year (Office of the Chief Economist, Australia 2018). As the level of development in Mainland China rises to equal that of other Asian cities, the expansion of steel demand in China represents a material outgrowth of the country's rapid urbanization (Hu et al. 2010). More than two-thirds of Chinese steel demand is driven by construction; the rest is used for machinery, automobiles, household appliances, railways, and shipbuilding (Mittal 2018). While China's domestic economic growth has slowed, the country's export of surplus steel production by developing infrastructure overseas helps prevent a key generative sector from faltering. Beijing's foreign undertakings like the Belt and Road Initiative allow the country to offshore its iron- and steel- intensive construction industry to new frontiers, or the "off-world."

The specialization of the Chinese steel industry has also caused its growth to be articulated differently than that of Japan and Korea in the past. China's production of long products, typically used in construction, has grown significantly in recent years, while sales of flat products, which are more typically used in manufacturing products like automobiles, have remained stable (Reserve Bank of Australia 2018). Whereas Japan and South Korea's outward expansion of their generative sectors took the form of exports like automobiles and ships, China's expansion involves the export of capital goods like railways and airports, which make their mark on remote regions depicted as lacking in transportation infrastructure, like the Arctic. Sitting at the center of Asia, North America, and Europe, the region is often imagined as providing a logical transportation shortcut between these three major markets, especially as climate change reduces sea ice. The circumpolar north is not just a resource frontier but also a transportation frontier: a place previously relatively unincorporated into global networks of trade and movement where there is now a perceived need—generally from the outside but sometimes also from within—to connect the "off-world" to the global core. Resource frontiers often double as transportation frontiers because commodities cannot be extracted without power plants, transmission lines, railways, and the like.

Due to their mutual dependence, the generative sectors of iron and steel can set in motion a positive feedback loop of both extraction

and intensification. Extraction involves the removal of ore from the ground, while intensification comprises the construction of steel-based infrastructure smelted out of that very mineral. The development of infrastructure in resource peripheries can thus exacerbate dependence on export-oriented sectors, peripheralizing them even as they become more connected and integrated into the core economy. This connectivity is also precarious: as demonstrated with the case of the Bloom Lake Mine and the Port de Sept-Îles, these links can suddenly collapse once a commodity becomes unprofitable or undesirable, scarring distant parts of the planet with severe environmental degradation and large-scale yet obsolete infrastructure. In contrast, the development of infrastructure in an ascendant economy allows it to monopolize generative sectors, determine standards for new economies of scale, and set the prices of global commodities. Over time, the ascendant country's economy is also likely to shift away from heavy industry and towards service sectors, further removing it from environmental risks.

Indeed, as China's steelmaking sector and its overall economy gain strength, the country is moving into more advanced sectors like shipbuilding and oil rig construction that allow it to project power in northern spaces. China has started to build polar-class vessels, which require more advanced forms of steel and ice breaking technology. In September 2018, the country unveiled its first domestically constructed icebreaker, *Xuelong 2*. The ship's construction was made possible thanks to China's recent advances in manufacturing low-temperature steel, with the Institute of Marine Materials Science and Engineering and Baosteel, a major Chinese steel conglomerate, together developing and mass producing close to one thousand tons of the product for use in the icebreaker (Xue 2019).

Other Chinese steel producers that have recently begun manufacturing steel for use in low temperatures includes HBIS Group Limited. The conglomerate's self-described transformation strategy, following a motto of "stretching farther and wider," involves expanding its portfolio to include everything from steel to industrial finance. Until recently, HBIS owned 25 percent of the Kami Project, a proposed iron ore mine in Canada's Labrador Trough. The other 75 percent was owned by Alderon Iron Ore, which found itself turning to a Chinese electronics producer and investor, Tunghsu Group, in order to try to gain greater access to Chinese loans. When Tunghsu ceased the transaction due to uncertainties generated by the COVID-19 pandemic, Alderon found itself unable to pay back a $14 million loan to Sprott Resource Lending, the company partly financing the Bloom

**Figure 5.2.** *The boreal forest has been razed from the land on which the Kiruna mine sits, replaced by tailing piles and train tracks.*


Lake mine. Sprott took over its share, and the mine was sold in April 2021 to Australian company Champion Iron Ore, which also owns Bloom Lake. Announcing the closing of the acquisition, and confirming the view among iron ore mining companies in which bigger is always better and the spreading of risks to additional parts of the planet is a good strategy, Champion's CEO David Cataford offered in highly financialized and detached language: "This acquisition adds a large scale and highly prospective project to our portfolio. In addition, by securing additional port capacity, this further de-risks our Bloom Lake Phase II expansion project, which is currently under construction" (Champion Iron 2021).

As China's iron and steel industries are vertically integrating, their impacts are extending across the world's resource frontiers. HBIS has sold ten thousand of its one-hundred-millimeter-high, heat-input welding plates, which are used in polar icebreakers and polar condensate ships (SteelClik 2017). These are the types of ships used to transport liquefied natural gas from places like the Yamal LNG project on Russia's north coast, in which China is a major investor, to Asia and Europe. China's improving ability to manufacture steel that can be used to build ice-class ships affords the country added mobility and in-

creases its ability to project power far from its sovereign territory. The Chinese economy becomes further detached from its territorial basis while resource frontiers like the Arctic are sedimented into place via the construction of iron-clad infrastructures built to match the needs of the ascendant economy (Figure 5.2). As Arrighi and Drangel (1986: 56) write: "The industrialization of the semiperiphery and periphery has ultimately been a channel, not of subversion, but of reproduction of the hierarchy of the world-economy." While China's offshoring of its steel-intensive infrastructure to the off-world may promise meaningful development, it can exacerbate underdevelopment, too.

## Abstracting Extraction: From Blue Skies to Iron Ore Futures

China pours money and infrastructure into resource and transportation frontiers like the Arctic, allowing it to materially reconfigure these spaces to support its own ascendance. Yet the country's activities are also more abstractly altering markets for iron and steel. Despite the economy's enormous material needs, China can remove itself from many of the more destructive realities of the iron and steel sectors by passing these burdens to the off-world. This abstraction depends upon both environmental policy, namely China's drive to clear the air in cities located close to its steelmaking sector, and financial policy involving the opening of iron ore futures and options exchanges.

China's drive to make its steel production cleaner is operationalizing distant peripheries that possess high-grade iron deposits. China's steel production is located near the country's iron ore bodies, which supplied its steel mills from the 1950s through the 1970s, when China began diversifying its sources of iron ore with imports (Tcha and Wright 1999). The blast furnaces in Hebei, the province encircling Beijing, produce more crude steel than any other province in China. Generating over 100 Mt of steel per year (Holloway, Roberts, and Rush 2010), these steel mills blacken the skies over the nation's capital. To reduce pollution, the central government has introduced numerous policy interventions. For instance, the Thirteenth Five-Year Plan (2016-20) called for phasing out 150 million tons of low-quality and heavily polluting steel capacity. These directives are driving up the price for higher-grade iron and pushing producers to develop now-lucrative resources in places like the Arctic. As the Kami Project's former president expressed in 2018, "The market has changed and the reason for that is, really, China's drive to clean up its air pollution" (Barker 2018).

The Chinese state's desire to improve air quality, especially in its wealthier cities, is also affecting the Arctic. With three hundred million people projected to move into China's cities over the next thirty years (Zheng and Kahn 2017), steel use will further increase given the steel-intensive, high-rise architectural form common across Chinese cities. Concerns about environmental quality and demands for cleaner air will likely keep pace (Zhang et al. 2010). In response, the Chinese government has launched policy initiatives such as the Blue-Sky Protection Campaign initiated in 2018 to clear the air around its cities, especially in the northeast, where steel smelters generate much of the pollution. Part of the ecological burden of cleaning up China's first-tier cities will fall on secondary cities, increasing domestic environmental inequality (Zheng and Kahn 2017). The other part of the burden will fall farther away in resource peripheries, as opportunities accrue in national capitals and in areas of demographic concentration.

Cities like Beijing and Shanghai are benefiting from the cleanup of the iron and steel industries, and they are also profiting from the financialization of commodities. Although financialization has a range of conceptions in the social sciences (French, Leyshon, and Wainwright 2011), here I simply define it as the dramatic influx of investments into commodities, which began in the 2000s and has since grown more than tenfold. Mines try to insulate themselves from the vagaries of global commodity cycles by increasing production in order to lower per-unit operating costs, a strategy that exacerbates environmental degradation. In contrast, China protects itself from volatility through financialization, which, entailing practices of geographic detachment and "abstract labor," represents the opposite of mining (Bernards 2020; Pike and Pollard 2010). By financializing commodities like iron and steel, the Chinese government enhances its status as a price-maker rather than a price-taker (Xu and Serapio 2018). Following the restructuring of the iron ore market in 2009, for instance, the Chinese government opened iron ore and steel rebar futures and options exchanges (Geman 2018; Ma 2013; Musacchio, Khanna, and Bernhardson 2010). Today, the world's top two metal futures contracts are steel rebar futures on the Shanghai Futures Exchange and iron ore futures on the Dalian Commodities Exchange. Illustrating the transmogrification of a whole range of specialized steel-related products into complex derivative financial instruments, the Shanghai exchange also lists "hot rolled coils, coke, iron coking coal, iron ore, silico-manganese and ferrosilicon" (Kim, Lim, and Kim 2018).

Rather than trading commodities themselves, futures exchanges revolve around contracts for buying and selling items at a later date

(Chari and Jagannathan 1990). In 2013, trading volumes on Chinese exchanges increased substantially with the introduction of iron ore futures contracts for physical delivery (Tamvakis 2018). On some days, volumes of iron ore futures traded on Chinese exchanges can exceed actual annual imports (Ng 2016). In 2016, a *Wall Street Journal* headline declaring that "In China, the New Casino is Iron Ore" exemplified the rise of "casino capitalism," whose glitzy hubs are the world's metropolitan financial hubs (Krätke 2014). Iron ore speculation drove prices up to US $90 a ton in 2017 (Scutt 2017). In 2021, they reached record highs of over $200. Sustained price increases based on speculation as opposed to fundamentals could mislead resource frontiers to invest in extraction-oriented infrastructure, with indelible impacts on the environment and society. One financial observer worrisomely remarked in May 2021: "At present, market participants are trading iron ore derivatives like cryptocurrency . . . not based on fundamentals, just pure momentum" (Zhang and Singh 2021). In the rare times that speculators encounter the actual commodities they are trading, the results can be chaotic. In one instance, although contracts are meant to ensure convergence between spot (real-time) and futures prices, speculation led to huge amounts of iron ore being delivered to exchange warehouses in Dalian, which only allows expiring contracts to be settled via delivery rather than in cash (Li 2016). The abstract financial accumulation that normally takes place in world cities thus took on a visceral form more typically seen off-world.

This remarkable incident aside, speculators generally profit from their actions regardless of whether mining (or even delivery) takes place since they trade in the invisible world of futures contracts. In contrast, the supply side can profit only if it actually mines the Earth. This difference in how value is derived indicates an unequal distribution of ecological risk that is growing more severe. As commodity chains integrate more remote areas, former suppliers whose resources have been exhausted are stuck cleaning up the environmental and economic wreckage left behind. Meanwhile, commodities speculators are concentrating themselves in financial centers. The three cities that have exchanges on which iron ore futures, for instance, are traded are Dalian, Singapore, and Hong Kong. As these cities accumulate capital and physical stores of iron and steel that sit in warehouses or are transformed into skyscrapers, the off-world is relegated to serving as a supplier of raw materials and as a repository for surplus steel that might just have been sourced from their own open pits.

## "Off-World and Back . . . Frontiers!"

China's iron ore and steel sectors are restructuring global commodity chains in far-reaching ways, to the off-world and back.[2] As generative sectors, China's expanding iron ore imports and steel exports have produced economies of scale that have lowered transportation costs to the degree that places as remote as the Arctic can now feasibly supply the bulk commodity to East Asia, despite the region lying tens of thousands of kilometers away. Consequently, suppliers in the Arctic are reconfiguring their operations in anticipation of exporting to China, both speculatively and with the support of actual Chinese investments. Even operations at mines that do not export their ore to China, such as Kiruna, are influenced by the country's market dominance. Yet as northern iron ore mines upscale their operations, their economic and environmental risks increase.

Meanwhile, China is consolidating its position within global iron ore and steel markets thanks to economic, technological, and financial advances. The country's ability to realize larger economies of scale both supports and is supported by its production of bigger, more capable vessels, such as Chinamax ships. China can also contribute to the wider development of polar infrastructure thanks to its ability to produce ice-class steel forged from iron ore sourced from increasingly distant locales. Additionally, China's rationalization, vertical integration, and financialization of its iron and steel sectors enhance the country's ability to influence prices and reduce its own exposure to volatility. While the burdens of China's economic growth fall disproportionately on the off-world, back home, the country's first-tier cities like Beijing and Shanghai are benefiting from the government's efforts to improve urban environments. Cities associated with the iron ore and steel trades are also accumulating profits thanks to the government's drive to become a price-setter rather than a price-taker through the creation of futures and options exchanges.

Iron and steel remain earthly substances. But the lengthening of commodity chains combined with their financialization risks exacerbates the disconnect between the ascendant economy and its most peripheral resource frontiers. New iron ore mines are opening at higher latitudes, such as the Mary River Mine on Canada's Baffin Island at 71°N. The widening distance between buyers and suppliers may make it easier for core markets to ignore the irreversible and disproportionate environmental degradation occurring within these resource frontiers. At the same time, new groups that find themselves

imbricated within elongated global commodity chains are mobilizing against the expansion of extraction. In February 2021, Inuit hunters erected a blockade on the Mary River Mine's airstrip to protest plans to double production, which the operator, Baffinland (owned by investors in Luxembourg and Texas), argues is critical to keeping operations profitable. Across Baffin Bay in Greenland, general elections held in April 2021 saw the *Inuit Ataqatigiit* party, which opposes uranium mining, command a plurality of votes. As China's frontier of scale expands, it will also encounter new forms and sources of resistance.

China's "strategic new frontiers" encompass remote, virtual, and off-world domains in a way that makes their terrestrial predecessors look downright parochial. Beijing's practices and discourses are reproducing the centuries-long history of state-led frontier development. However, the size of China's commodity demands—both fundamentally and in terms of how they are envisioned—may endow the country with the ability to enclose domains not yet even in the realm of imagination. The extension of China's mining frontier to asteroids and the moon, for instance, is an express goal of China's space agencies (Goswami 2018). More abstractly but no less importantly, the presumed insatiability and inertia of the country's commodities quest, however illusory, feed speculation that the "specter of China" will soon loom large in outer space. Incidentally, anticipating the future can hasten its arrival, as speculative investments in mining and transportation infrastructure across the Arctic iron ore frontier indicate.

The Arctic could prove to be a laboratory for the construction of a truly off-world frontier in which massive generative sectors help unlock new resource deposits. Knowledge gained from testing and deploying infrastructure and technology in harsh and remote locations could allow China's economy to eventually enclose ferrous asteroids or the moon. At the same time, more "virtual" innovations, such as the financialization of commodities, allow speculators to capture value from mining without having to engage in the dirty business themselves. These dynamics demonstrate how the operationalization of the circumpolar north depends on more than just climate change and interstate competition (Bruun and Medby 2014; Dittmer et al. 2011; Koivurova 2011). In the Arctic, China is doing the "work" required for future accumulation, as Mason suggests in his introduction, not so much by waiting passively for climate change to unlock new opportunities, but rather by doing everything from forging low-temperature steel to closing "zombie companies" and designing complex finan-

cial products. Together, these innovations may help to secure China's place not only within the world but in more digital spheres and perhaps even on other planets, too.

Back on Earth, things may not be so shimmery. In one of *Blade Runner's* opening scenes, a neon advertisement broadcasts over a rain-slicked grimy street: "A new life awaits you in the Off-world colonies! A chance to begin again in a golden land of opportunity and adventure!" The footloose and free can always chase fortune. But what of the people left behind in the forgotten and rusting frontiers? At first having chased the specter of demand, they may now be haunted by it.

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## Notes

1. The author is grateful to Trym Eiterjord for tracking down information regarding how many VLOCs have been built, which is sourced from numerous Chinese-language media reports.
2. The section's title was originally included as a line in the "Tears in Rain" monologue from the end of *Blade Runner* as written by screenwriter David Peoples. The line did not appear in the final film, however, as the actor, Rutger Hauer, ended up improvising his soliloquy.

## References

Arrighi, Giovanni and Jessica Drangel. 1986. "The Stratification of the World-Economy: An Exploration of the Semiperipheral Zone". *Review: A Journal of the Fernand Braudel Center for the Study of Economies, Historical Systems and Civilizations*, 10: 9–74.

Andersson, P. S. 2021. "The Arctic as a 'Strategic' and 'Important' Chinese Foreign Policy Interest: Exploring the Role of Labels and Hierarchies in China's Arctic Discourses." *Journal of Current Chinese Affairs*.

Barker, J. 2018. "Kami Mine Project Looking Good for Labrador West—Except for That $1B Price Tag." *CBC News*, 1 October. Retrieved June 20, 2020, from https://www.cbc.ca/news/canada/newfoundland-labrador/alderon-kami-mine-feasibility-study-1.4842789

Bernards, N. 2020. "Centring Labour in Financialization." *Globalizations* 17(4): 714–29.

Boutet, J.-S. 2015. "The Revival of Québec's Iron Ore Industry: Perspectives on Mining, Development, and History." In *Mining and Communities in Northern Canada: History, Politics, and Memory*, edited by A. Keeling and J. Sandlos, 169–206. Calgary: University of Calgary Press.

Bruun, Johanne M., and Ingrid A. Medby. 2014. "Theorising the Thaw: Geopolitics in a Changing Arctic." *Geography Compass* 8(12): 915–29.

Bunker, Stephen G., and Paul S. Ciccantell. 2003. "Generative Sectors and the New Historical Materialism: Economic Ascent and the Cumulatively Sequential Restructuring of the World Economy." *Studies in Comparative International Development* 37(4): 3–30.

Carlson, Lucile. 1952. "The Mining District of Kiruna Stad, Sweden." *The Scientific Monthly* 74(2): 76–83.

Century Global Commodities. 2018. "WISCO." Retrieved February 12, 2020, from http://centuryglobal.ca/corporate/strategic-partners/wisco.

Champion Iron. 2021. "Champion Iron Announces the Closing of the Kami Project Acquisition," 1 April 2021. Retrieved January 25, 2022 from https://newsroom.championiron.com/2021-04-01-Champion-Iron-Announces-the-Closing-of-the-Kami-Project-Acquisition.

Chari, V. V., and Ravi Jagannathan. 1990. "The Simple Analytics of Commodity Futures Markets: Do They Stabilize Prices? Do They Raise Welfare?" *Federal Reserve Bank of Minneapolis Quarterly Review* 14(3): 12–24.

Ciccantell, Paul S., and Stephen G. Bunker. 2004. "The Economic Ascent of China and the Potential for Restructuring the Capitalist World-Economy." *Journal of World-Systems Research* 10(3): 565–89.

Ciccantell, Paul S., and David A. Smith. 2009. "Rethinking Global Commodity Chains: Integrating Extraction, Transport, and Manufacturing." *International Journal of Comparative Sociology* 50(3–4): 361–84.

Dittmer, Jason, Sami Moisio, Alan Ingram, and Klaus Dodds. 2011. "Have You Heard the One about the Disappearing Ice? Recasting Arctic Geopolitics." *Political Geography* 30(4): 202–14.

Du, Juan. 2016. "'Zombie Companies' Adjust to New Reality," 15 March. *China Daily*. Retrieved January 25, 2022 from http://english.www.gov.cn/news/top_news/2016/03/15/content_281475307803899.htm

Economy, Elizabeth C., and Michael Levi. 2014. *By All Means Necessary: How China's Resource Quest Is Changing the World*. Oxford, UK: Oxford University Press.

Feng, Lintong. 1994. "China's Steel Industry: Its Rapid Expansion and Influence on the International Steel Industry." *Resources Policy* 20(4): 219–34.

French, Shaun, Andrew Leyshon, and Thomas Wainwright. 2011. "Financializing Space, Spacing Financialization." *Progress in Human Geography* 35(6): 798–819.

Geman, Helyette. 2018. "Fertilizers Markets: In Search of the Index of Choice." In *The Financialization of Commodity Markets: A Short-Lived Phenomenon?*, edited by Yves Jégourel, 17–32. Rabat, Morocco: OCP Policy Center.

Goswami, Namrata. 2018. "China in Space Ambitions and Possible Conflict." *Strategic Studies Quarterly* 12(1): 74–97.

Government of Canada. 2014. "Port of Sept-Îles: Backgrounder," 14 October. Retrieved January 25, 2022 from https://www.canada.ca/en/news/archive/2014/10/port-Sept-Îles.html

Holloway, James, Ivan Roberts, and Anthony Rush. 2010. "China's Steel Industry." *Bulletin.* (December Quarter). Reserve Bank of Australia.

Hong, Nong. 2012. "The Melting Arctic and Its Impact on China's Maritime Transport." *Research in Transportation Economics* 35(1): 50–57.

Hu, Mingmin, Stefan Pauliuk, Tao Wang, Gjalt Huppes, Ester van der Voet, and Daniel B. Müller.. 2010. "Iron and Steel in Chinese Residential Buildings: A Dynamic Analysis." *Resources, Conservation and Recycling* 54(9): 591–600.

Ingold, Tim. 2007. "Materials against Materiality." *Archaeological Dialogues* 14(1): 1–16.

Jakobsen, Linda, and Seong-Hyon Lee. 2013. "The North East Asian States' Interests in the Arctic and Possible Cooperation with the Kingdom of Denmark." Report prepared for the Ministry of Foreign Affairs of Denmark. Stockholm: SIPRI. Retrieved May 3, 2020, from https://www.sipri.org/publications/2013/north-east-asian-states-interests-arctic-and-possible-cooperation-kingdom-denmark.

Jiang, Liping, Erik Bastiansen, and Siri P. Strandenes. 2013. "The International Competitiveness of China's Shipbuilding Industry." *Transportation Research, Part E* 60: 39–48.

Jorgenson, Jon. 2010. "Iron Ore." In *Minerals Yearbook: Metals and Minerals 2010*, 910–20. Reston: US Geological Survey.

Klinger, Julie Michelle. 2017. *Rare Earth Frontiers: From Terrestrial Subsoils to Lunar Landscapes*. Ithaca: Cornell University Press.

Kim, Kyoungsu, Seok Lim, and Kyoungsu Kim. 2018. "Price Discovery and Volatility Spillover in Spot and Futures Markets : Evidences from Steel-Related Commodities in China." *Applied Economics Letters* 26(5): 351–57.

Kirk, William S. 2004. "China's Emergence as the World's Leading Iron-Ore–Consuming Country." *Minerals and Energy: Raw Materials Report* 19(2): 16–27.

Koivurova, Timo. 2011. "Scramble for Resources or Orderly Development: What Is Happening in the Arctic?" In *Nordic Cooperation and the Far North*, edited by Laura Salmela, 1–13. Helsinki: Maanpuolustuskorkeakoulu.

Krätke, Stefan. 2014. "Cities in Contemporary Capitalism." *International Journal of Urban and Regional Research* 38(5): 1660–77.

Lanteigne, Marc. 2017. "'Have You Entered the Storehouses of the Snow?' China as a Norm Entrepreneur in the Arctic." *Polar Record* 53(2): 117–30.

Lavento, Mika. 1999. "An Iron Furnace from the Early Metal Period at Kitulansuo in Ristiina, in the Southern Part of the Lake Saimaa Water System." *Fennoscandia Archaeologica* 16: 75–80.

Lee, Ching Kwan. 2017. *The Specter of Global China: Politics, Labor, and Foreign Investment in Africa*. Chicago: University of Chicago Press.

Li, Hongmei. 2016. "Physical Delivery into China's DCE Iron Ore Futures Contracts Hit Record High for January." *S&P Global Platts*, 22 January. https://www.spglobal.com/platts/en/market-insights/latest-news/metals/012216-physical-delivery-into-chinas-dce-iron-ore-futures-contracts-hit-record-high-for-jan.

Liu, Nengye. 2018. "Will China Build a Green Belt and Road in the Arctic?" *Review of European, Comparative and International Environmental Law* 27(1): 55–62.

Ma, Yiqun. 2013. "Iron Ore Spot Price Volatility and Change in Forward Pricing Mechanism." *Resources Policy* 38(4): 621–27.

Maddison, Angus. 2007. *Chinese Economic Performance in the Long Run, 960–2030 AD.* 2nd ed. Paris: OECD Development Centre.

Marowits, Rose. 2017. "Bloom Lake Iron Mine Poised to Return to Production." *CBC News*, 15 November. Retrieved January 25, 2022 from https://www.cbc.ca/news/canada/newfoundland-labrador/bloom-lake-iron-ore-1.4403905.

Mayes, W. M., D. Johnston, H. A. B. Potter, and A. P. Jarvis. 2009. "A National Strategy for Identification, Prioritisation and Management of Pollution from Abandoned Non-Coal Mine Sites in England and Wales: Methodology Development and Initial Results." *Science of the Total Environment* 407(21): 5435–47.

McKay, Huw, Yu Sheng, and Ligang Song. 2010. "China's Metal Intensity in Comparative Perspective." In *China: The Next Twenty Years of Reform and Development*, edited by Ross Garnaut, Jane Golley, and Ligang Song, 73–98. Canberra: ANU Press.

Mittal, Aditya. 2018. Presentation at the Bank of America Merrill Lynch 2018 Global Metals, Mining and Steel Conference, Miami, FL, 15–17 May. https://corporate-media.arcelormittal.com/media/ztjhyng4/bofaml-miami-may-18.pdf

Musacchio, Aldo, Tarun Khanna, and Jenna Bernhardson. 2010. "In the Spotlight: The Market for Iron Ore." *Harvard Business School Background Note* 710-049.

Ng, Jasmine. 2016. "Goldman Says China's Iron Speculation 'Concerns Us the Most.'" *Bloomberg*, 26 April. Retrieved January 25, 2022 from https://www.bloomberg.com/news/articles/2016-04-26/goldman-says-china-iron-ore-speculation-concerns-us-the-most.

Office of the Chief Economist, Australia. 2018. *Steel: Resources and Energy Quarterly*. Retrieved August 13, 2020, from https://www.industry.gov.au/data-and-publications/resources-and-energy-quarterly-all.

Pike, Andy, and Jane Pollard. 2010. "Economic Geographies of Financialization." *Economic Geography* 86(1): 29–51.

Port de Sept-Îles. 2013. "A North-American Milestone: The First Chinamax Vessel Will Be Loaded in the Port of Sept-Îles." Press release, 16 October. https://www.portsi.com/a-north-american-milestone-the-first-chinamax-vessel-will-be-loaded-in-the-port-of-Sept-Îles.

Rainwater, Shiloh. 2013. "Race to the North: China's Arctic Strategy and Its Implications." *Naval War College Review* 66(2): 62–82.

Reserve Bank of Australia. 2018. "Box B: An Update on China's Steel Sector." *Statement on Monetary Policy*. Retrieved April 27, 2020, from https://www.rba.gov.au/publications/smp/2018/aug.

Risto, R. W., M. W. Kociumbas, R. Martinez, J. Lord, E. Giroux, M. Côté, S. Buccitelli, J. Cassoff, and A. Bolard. 2015. *Lac Otelnuk Project Feasibility Study*. Technical Report, NI 43-101. Retrieved January 22, 2022 from https://gq.mines.gouv.qc.ca/documents/examine/GM69052/GM69052.pdf.

Sand, Peter. 2013. "China Breaks New Ground . . . Again." *BIMCO*, News, 13 February. https://www.bimco.org/news/market_analysis/2018/20180213_china_breaks_new_ground.

Scutt, D. 2017. "Chinese Iron Ore Speculators Are Back and They're Selling." *Business Insider Australia*, 26 May. Retrieved January 25, 2022 from https://www.businessinsider.com.au/chinese-iron-ore-speculators-are-back-and-theyre-selling-2017-5

Siddique, Abu. 2009. "Western Australia–Japan Mining Cooperation: An Historical Overview." In *An Enduring Friendship: Western Australia and Japan. Past, Present, and Future*, edited by David Black and Sachiko Sone, 159–76. Perth: University of Western Australia Press.

Solli, Per Erik, Elana Wilson Rowe, and Wrenn Yennie Lindgren. 2013. "Coming into the Cold: Asia's Arctic Interests." *Polar Geography* 36(4): 253–70.

State Council Information Office, People's Republic of China. 2018. "China's Arctic Policy." Retrieved July 7, 2020, from http://english.gov.cn/archive/white_paper/2018/01/26/content_281476026660336.htm.

SteelClik. 2017. "High Heat Input Welding Plate Developed By HBIS." SteelClik, 9 November. Retrieved January 25, 2022, from http://www.steelclik.com/web/article/details.htm?articleId=288&channelId=3.

Stepien, Adam. 2017. "Incentives, Practices and Opportunities for Arctic External Actors' Engagement with Indigenous Peoples." In *Arctic Law and Governance: The Role of China and Finland*, edited by Timo Koivurova, Tianbao Qin, Sebastien Duyck, and Tapio Nykanen, 205–32. Oxford, UK: Hart Publishing.

Tamvakis, Michael. 2018. "From Chicago to Shanghai and Dalian: Apprehending the Future of Chinese Commodity Derivative Markets." In *The Financialization of Commodity Markets: A Short-Lived Phenomenon?*, edited by Yves Jégourel, 125–47. Rabat, Morocco: OCP Policy Center.

Tcha, Moonjoong, and Damione Wright. 1999. "Determinants of China's Import Demand for Australia's Iron Ore." *Resources Policy* 25(3): 143–49.

Unger, Corinne et al. 2012. "Mapping Impacts and Prioritising Rehabilitation of Abandoned Mines at a National Level in Australia." Paper presented at the Life of Mine Conference, Brisbane, Australia, 10–12 July.

Van de Kletersteeg, Theo. 2012. "For Port of Sept-Îles, It's Almost All about Iron Ore." *Canadian Sailings*, 7 August. https://canadiansailings.ca/for-port-of-Sept-Îles-it's-almost-all-about-iron-ore.

Van der Linde, Damon. 2016. "How This Northeastern Quebec City Is Getting Burned by the Collapse in Iron Ore Prices." *Financial Post*, 8 January. https://business.financialpost.com/commodities/mining/canadas-iron-ore-industry-looking-for-relief.

Wilson, Jeffrey D. 2012. "Chinese Resource Security Policies and the Restructuring of the Asia-Pacific Iron Ore Market." *Resources Policy* 37(3): 331–39.

World Steel Association. 2018. *World Steel in Figures 2018*. Brussels. World Steel Association.

Wu, Yanrui. 2000. "The Chinese Steel Industry: Recent Developments and Prospects." *Resources Policy* 26(3): 171–78.

Xu, Muyu, and Manolo Serapio Jr. 2018. "China Vows to Open up More Futures Markets as Iron Ore Goes International." *Reuters*, 4 May. https://www.reuters.com/article/us-asia-ironore/china-vows-to-open-up-more-futures-markets-as-iron-ore-goes-international-idUSKBN1I503N.

Xue, Mingsuo. 2019. "Xuelong 2's Second Engineer and Special Low-Temperature Polar Steel Both Come from Lingang New Area." *Interface News,* 15 Octo-

ber (in Chinese). Retrieved September 14, 2020, from https://m.jiemian.com/article/3580840.html.
Zernov, Vladimir. 2015. "Cliffs Natural Resources: The Historic Example Of Value Destruction." *Seeking Alpha*, 15 December. https://seekingalpha.com/article/3756366-cliffs-natural-resources-historic-example-of-value-destruction.
Zhang, Junfeng et al. 2010. "Environmental Health in China: Progress towards Clean Air and Safe Water." *Lancet* 375(9720): 1110–19.
Zhang, Min, and Shivani Singh. 2021. "China Iron Ore, Steel Prices Hit Record as Supply Worries Prompt Speculative Buying." *Reuters*. Retrieved 17 May 2021 from https://www.reuters.com/article/asia-ironore-idUSL4N2MX0OQ.
Zhao, Guochun, and Jinghui Guo. 2012. "Precambrian Geology of China: Preface." *Precambrian Research* 222–223: 1–12.
Zheng, Siqi, and Matthew E. Kahn. 2017. "A New Era of Pollution Progress in Urban China?" *Journal of Economic Perspectives* 31(1): 71–92.

CHAPTER 6

# Constructing and Contesting Temporalities in the Mackenzie Gas Project

Carly Dokis

> In the Canadian context, colonial domination continues to be structurally committed to maintain—through force, fraud, and more recently, so-called negotiations—ongoing state access to the land and resources that contradictorily provide the material and spiritual sustenance of Indigenous societies on the one hand, and the foundation of colonial state formation, settlement, and capitalist development on the other.
>
> —Glen Coulthard, *Red Skin, White Masks*

In 2005 the Mackenzie Gas Project, a consortium of five energy companies, ran a series of advertisements in *Up Here*, the in-flight magazine of Canadian North Airlines. The headline read "Mackenzie Gas Project: Pipeline to the Future," with text below it describing "a project that, if built, will pave the way for long-term economic growth for the North." The substance of the proposal was to develop three onshore gas fields in the Mackenzie Delta district of Canada's Northwest Territories and to transport the resulting natural gas and natural gas liquids through a 1,220-kilometer pipeline to facilities in Alberta. For transnational energy corporations, the Mackenzie Gas Project would open up Northern energy frontiers by providing infrastructure to transport natural gas from the Canadian Arctic and sub-Arctic to existing pipeline networks in Alberta and, from there, on to southern consumers. But, for critical observers, the Mackenzie Gas Project was

also a social construct by which high prices for oil and natural gas and anticipated increases in demand for these commodities in the first decade of the twentieth century fueled imaginaries of undeveloped frontiers, exponential growth, and opportunities linked not only to visions of profits but also to Canadian sentiments of Northern expansion and progress.

Energy corporations, and other extractive industries, have long cast their gaze North to what they saw as untapped resources and possibilities. Facilitated by technologies of abstraction, such as the map and survey, the North was imagined as an extractive-space that was discursively and materially central to the production of Canada and seen as vital to its economic future (Peyton and Keeling 2017). While early extractive projects have drawn critical attention for their role in colonial dispossession of Indigenous lands, extractive projects that emerged in the early part of the twentieth century did so in the contexts of new legal and political arrangements that outwardly demonstrated increasing recognition and accommodation of Indigenous self-government and land rights. Comprehensive land claim agreements, which had been reached with many of the Indigenous groups along the pipeline's right-of-way in the 1980s and 90s, outline specific mechanisms for the participation of Indigenous peoples in land-use decision-making, including their representation on regulatory boards. These agreements, as well as emerging Canadian legal jurisprudence, require consultation and negotiation with Indigenous governments and land claim bodies for corporations wishing to gain access to various categories of land—and for the Canadian state when it wants to open land up for resource extraction. In contrast to previous eras of extractivism in the Canadian North, which were deeply informed by colonial and racialized notions of *terra nullius* and subsequent state refutation of Indigenous rights and responsibilities to their territories, Indigenous peoples in the North were now recognized by the state and energy corporations as necessary participants in the development of the Mackenzie Gas Project.

The problem with contemporary politics of recognition, as Dene scholar Glen Coulthard points out, is that in Canada these political, structural, and discursive processes have tended to reinforce rather than transform colonial relationships and the particular political, socioeconomic, and ecological relations of domination and exploitation that underpin them. In his book *Red Skin, White Masks*, Coulthard (2014) convincingly shows how political instruments of state recognition—comprehensive land claims, economic development initiatives, and self-government agreements—transform once overt forms of co-

lonial rule into structures of domination that work as much through interpolation and participation as they do through dispossession. A key part of this dynamic, Coulthard argues, is the maintenance of state access to lands and resources for the purposes of extraction and the integration of Indigenous peoples and ways of life into modern capitalism, both secured through the state's insistence on prescribed forms of recognition and reconciliation that do not fundamentally threaten colonial relations of power. As Coulthard argues:

> For the state, recognizing and accommodating "the cultural" through the negotiation of land claims [did] not involve the recognition of alternative Indigenous economies and forms of political authority. . . . Instead, the state insisted that any institutionalized accommodation of Indigenous cultural difference be reconcilable with one political formation—namely, colonial sovereignty—and one mode of production—namely, capitalism. (2014: 28)

Inasmuch as state access to Indigenous lands is secured through structural means, as Coulthard describes, it is also assured and maintained through discursive and material practices that abstract particular temporalities and narratives of the colonial past and the neocolonial present and future. As social constructions, these discourses and materialites are not only sustained by politics of recognition but also operate through them, cementing political-economic abstractions that relegate colonial injustices to the past while simultaneously delineating possible futures seen as inevitably tied to resource extraction and the expansion of petrocapitalism.

This chapter examines the abstraction and contestation of such temporalities in the planning of the Mackenzie Gas Project. Recent scholarship on extraction has suggested that in addition to foregrounding the effects of extractive industries at local and global scales, studies of extraction should attend to the particular discursive and ideological logics of extractivism that normalize the processes through which wealth is generated by the exploitation and subjectification of lands and peoples, as well as related connections between global capitalism, colonialism, and neoliberalism (Junka-Aikio and Cortes-Severino 2017; Szeman 2017; Veltmeyer and Petras 2014). In the context of the Canadian North, institutional forms of resource governance born out of comprehensive land claim agreements provide the administrative mechanisms through which the state assesses the viability of extractive projects and the social, cultural, and ecological consequences of such endeavors. Drawing on documents generated for and by the regulatory review process, community hearing transcripts, and

participant-observation conducted in three Sahtu communities and in the city of Yellowknife between 2004 and 2007, I examine the temporal discourses produced through the regulatory assessment of the Mackenzie Gas Project. Though my analysis is especially focused on the Sahtu Region of the Central Mackenzie Valley, a region that has no all-season road and lies outside of the onshore gas fields that were the focus of the regulatory review, I maintain that important insights about the discursive construction of extractive imaginaries can be gleaned from the Sahtu Dene peoples' experiences of the regulatory process. How did diverse temporal representations inform the imagination of abstract futures? How did hearing participants challenge these representations, and what kinds of alternatives did they offer in their place? How were these representations anticipated, taken up, or contested by Indigenous people? And how might such constructions challenge the presumed rationality of extractivism and the assumption that the integration of Northern lands and peoples into capitalist modernities is inevitable? The answers to these questions are significant, I argue, not only for the ways in which they represent historical and contemporary Indigenous–state relations, but also for the ways in which they absorb us all—Indigenous and non-Indigenous alike—into extractivist futures that rest on shaky articulations between transnational flows of capital and illusions of wealth and stability generated by ideologies of petroleum extraction (see also Watts 2004).

## The Project in Space and Time

At the time that it was proposed, the Mackenzie Gas Project was to be the largest industrial project ever undertaken in the Canadian North and was characteristic of the kinds of extended infrastructure proposed in the early twenty-first century to support transnational extractivist projects. The National Energy Board pointed out that, if built, the project would bring larger and more far-reaching impacts than previous extractive projects in the North, and "would bring a wave of construction activity on a scale never seen before in Canada north of the sixtieth parallel" (National Energy Board 2010: 17). Construction of the project was originally slated to begin in 2006. Three onshore gas fields in the Mackenzie Delta were to be developed: the Tagu natural gas field owned and operated by Imperial Oil; the Parsons Lake natural gas field, jointly owned by Exxon Mobil (25 percent) and ConocoPhilips (75 percent); and the Niglintgak natural gas field owned and operated by Shell Canada. Together, these facilities were projected to

produce about 1.2 billion cubic feet per day of natural gas (Mackenzie Gas Project 2004a), which would be transported through a pipeline to northwestern Alberta. The pipeline was actually designed to carry 1.8 billion cubic feet of natural gas per day, so that it could accommodate additional natural gas and natural gas liquids from future sources found in the Mackenzie Delta and Valley (Mackenzie Gas Project 2004a). The anticipated cost of the project in 2004 was $7 billion CAD.

These gas fields and over twelve hundred kilometers of steel pipeline would cross the ancestral homelands of the Inuvialuit, Dene, and Métis peoples. Indigenous peoples have lived in and cared for their territories in the Mackenzie Valley, called Denendeh by Dene peoples, since time immemorial. Though many First Nations in the Central Mackenzie Valley were signatories to Treaty 11, which covers portions of present-day Yukon and Northwest Territories and Nunavut, the treaty was never implemented, and a number of extractive industries operated in the region by the mid-twentieth century. Not only did these extractive projects carry heavy ecological and epidemiological impacts, but they also stood as stark reminders of the state's refusal to acknowledge Dene jurisdiction over their own territories.[1] Dene peoples benefited very little from these projects and were neither compensated nor consulted about any of the early extractive projects undertaken on their lands. In the 1970s, a number of factors including Indigenous activism and resistance to pipeline proposals, as well as court decisions to the effect that no pipeline should be built through the Mackenzie Valley until land claims have been settled, resulted in a reorientation of Indigenous–state relations in the Northwest Territories, prompting the federal government to initiate a new comprehensive land claims policy.[2] Comprehensive land claims were subsequently reached with the Inuvialuit in 1984, the Gwich'in in 1992, the Sahtu Dene and Metis in 1993, and the Tlicho in 2003. For the state, these new arrangements provided economic and political security by ensuring that Indigenous rights were specifically and legally defined. As Carole Blackburn (2005: 587) has noted, a major objective of the state in resolving outstanding Indigenous land claims was to provide "certainty" around the nature and extent of Indigenous rights, so that extractive industries operating on public lands would have "confidence that their operations will not be disrupted by Aboriginal claims" and thus would be willing to make investments in the extractive economy of the Canadian North, rather than moving their capital elsewhere (see also Coulthard 2014).

The Mackenzie Gas Project was thus based on a new model of economic development and stability for the North, one that invited

partnerships with Indigenous groups. In contrast to earlier extractive projects, one of the joint-venture partners was the Aboriginal Pipeline Group, a corporation formed to represent the interests of the Inuvialuit, Gwich'in, and Sahtu, whose territories are situated along the pipeline route.[3] A memorandum of agreement between the energy companies involved in the Mackenzie Gas Project provided the opportunity for the Aboriginal Pipeline Group to acquire a one-third interest in the pipeline, which they did through an $80 million dollar loan from TransCanada Corporation. The funding from TransCanada would cover the Aboriginal Pipeline Group's up-front costs for regulatory reviews and their share of construction costs; in exchange for the financing, TransCanada would receive a 5 percent interest in the pipeline. The involvement of the Aboriginal Pipeline Group meant that Indigenous land claim bodies would now be one-third owners of the pipeline, although they would have to find producers to fill their quota of gas shipped through the pipe.[4] With the Aboriginal Pipeline Group and land claim provisions in place, the development of the Mackenzie Gas Project was promoted as a new approach to extraction in the North, one that would galvanize economic prosperity for all.

However, not everyone was convinced that a pipeline through the Mackenzie Valley was the best hope for the future of the North. As people who continue to draw sustenance from their lands for purposes ranging from food security to emotional and spiritual well-being, many Dene people were deeply concerned about how the pipeline and an intensification of hydrocarbon extraction would affect their ability—and those of future generations—to pursue a Dene way of life (Dokis 2015). Though they wanted opportunities for employment, Dene people also prioritized maintaining a way of life lived in relationship with the land, one based on principles of mutual reciprocity and care and of not taking more than one needs.

The required environmental assessment of the Mackenzie Gas Project was initiated in 2003 when Imperial Oil, as operator of the project, submitted its Preliminary Information Package to Canada's National Energy Board. An agreement for an environmental review was subsequently executed in 2004 and set the terms of reference for the regulatory process that would follow. A key element of the terms of reference involved defining the parameters of what would or could be considered part of the environmental assessment, and these parameters were both spatial and temporal in nature. The assessment was to be limited to the project and related construction activities, and it revolved around current "baseline" conditions of communities and ecosystems and how the project might impact them. Historical

incursions into the lives of Dene people—policies of assimilation and relocation, abrogation of treaties, and damages of past extractive industries—were not part of the mandate of the review. The review assessed how the project might affect air quality or other adverse ecological effects within the project area but would not consider how it might add to global dependency on fossil fuels or what that might mean for the future of the planet. Though the Mackenzie Gas Project was widely considered to be a vehicle for future hydrocarbon extraction, the effects of these future projects could not be included as a part of this regulatory review because they remained hypothetical, not yet concrete. In short, the spatial and temporal construction of the impacts of the Mackenzie Gas Project circumscribed the kinds of discourses that could be considered as part of the review, and consequently contained the nature of concerns and questions that could be raised by Dene participants.

In 2006 and 2007, people from across the Northwest Territories and beyond were given the opportunity to voice their positions regarding the pipeline at one of the largest, most complicated environmental impact assessments and regulatory reviews in Canadian history. After two years of public hearings and nearly five years after the project's champions submitted their Environmental Impact Statement, the Joint Review Panel for the Mackenzie Gas Project issued its final report and recommendations, entitled "Foundation for a Sustainable Future," in December 2009. In it, the Panel concluded that a future with the pipeline would be better than one without it. The Joint Review Panel recommended to the National Energy Board that the project be built, subject to some 176 recommendations. Taking the Panel's recommendations into consideration, the National Energy Board recommended to the federal government that the project be approved, with the stipulation that construction on the pipeline had to begin by 2015.

As Brian Larkin (2018: 179) notes, infrastructures are metaphors as well as technical objects, ones that "bundle together a series of things that can be analytically separated, but in practice are often wrapped up together and hard to disentangle." Inasmuch as the Mackenzie Gas Project involved material infrastructure of steel, gravel, and concrete that would expand transportation networks and link hydrocarbons to markets, it was also an ideological and aesthetic device that signaled the aspirations of the state and Southern metropoles for Northern "development." Close attention to the ways in which these aspirations were performed (and contested) throughout the environmental assessment of the Mackenzie Gas Project reveals the stubbornness of colo-

nial developmental tropes—including progress, assimilation, and the configuring of capitalist subjects—that continue to inform Indigenous–state relations in Canada. The animation of these tropes involved the reiteration of what Hannah Appel (2018) has called "developmental time," discursive constructions of linear stages of development that equate notions of past, present, and future with the mobilization of infrastructure. Here, infrastructure serves as an indicator of modernity; it "comes to stand metonymically for development" (Appel 2018: 50). Tracking these narratives in the Mackenzie Gas Project assessment reveals that preparation for the pipeline required not only the development of technical designs and plans for the mitigation of social and environmental impacts, but also required the narrative abstraction of temporalities that situated Indigenous communities as underdeveloped and the expansion of hydrocarbon infrastructure as the means for economic salvation.

Yet in the end, the Mackenzie Gas Project was never built. Rising costs of steel and emerging technologies that allowed for the extraction of shale gas in more accessible regions made the project economically unfeasible as the price of natural gas plummeted. After a series of delays and rising project costs, Imperial Oil announced in December 2017 that natural gas prices could not justify the rising costs of the project and so dissolved the joint venture behind it. Media reports trying to make sense of this outcome cited the protracted regulatory process as one of the reasons that the project had stalled. An article in the *Globe and Mail* cautioned: "The epic length of the Mackenzie hearings is often cited as a cautionary tale about how the market can turn before a major project gets built" (Jones 2017). But in reality, it was the unpredictability and fluidity of transnational markets and the external demands of capital, not the regulatory process or the voices and concerns of Dene people, that stymied the project.[5] Drawing attention to the promises and expectations of infrastructure futurities, as well as their failures and abandonments, is thus essential for revealing the contingent nature of petrocapitalism and the complex intersections between extractivism and ongoing colonial formations.

## Recognition and Reconciliation: Historicizing Colonial Injustice

Recent scholarship on Indigenous–state relations in Canada has drawn attention to the workings of temporal constructions in state approaches to reconciliation, pointing out that discourses of reconciliation serve to historicize colonial injustices in ways that disarticulate

them from present forms of oppression. In her book *Finding Dahshaa*, Stephanie Irlbacher-Fox (2009) argues that by failing to connect current forms of social suffering with ongoing processes of colonialism, Canadian Aboriginal policy assumes that colonial injustices have been appropriately dealt with through processes of recognition and reconciliation, that historical wrongs have been addressed (through land claims, for example), and that as a consequences of this historicization, "a better life will emerge only if the past is left behind because circumstances in the past will not change" (Irlbacher-Fox 2009: 3). Implicit in this approach is that it is Indigenous peoples who must adapt to present conditions, who must move on from injustices of the past utilizing the new tools afforded to them by processes of reconciliation and recognition, and that they must overcome what are often characterized as personal rather than structural traumas in order to achieve a better life (see also Reynaud 2014).

Discourses about the past in the Mackenzie Gas Project regulatory process worked in much the same way. The settlement of comprehensive land claims was seen to have reconciled historical wrongs, and Indigenous land claim bodies were positioned as economic partners in the development and regulation of extractive industries. Indigenous peoples became landowners who were now seen as "ready" to take up their role as participants in the extractive economy. Meanwhile, the effects of historical and ongoing colonial incursions into Dene communities were largely absent from the regulatory review. The Environmental Impact Statement produced by Imperial Oil included a short section on the historical background of Indigenous peoples in the proposed project area and only briefly discussed the changes brought by contact with Euro-Canadians. This historical background lacked any critical engagement with contemporary scholarship on the ongoing effects of colonialism; instead, changes brought by the advance of colonial frontiers were presented as unchangeable, inevitable outcomes of modernization. Furthermore, the focus on current "baseline" conditions—as opposed to ongoing experiences of colonialism—meant that Indigenous communities (and cultures) were presented as having already been changed. Current conditions were understood to reflect underdevelopment, a lack of sustainable employment and infrastructure, and poor personal choices rather than the continuation of colonial formations. For example, when discussing community wellness, the Environmental Impact Statement reads:

> Community wellness depends on having healthy, happy individuals and families . . . Many health concerns are linked to the things people choose to do. People's health is often threatened by alcoholism, sexually transmit-

> ted infections, smoking, increased rates of diabetes, and babies born with fetal alcohol syndrome or fetal alcohol effect. Suicide is also a major and growing concern in the Northwest Territories . . . . The project might contribute to the good health of individuals and families through employment opportunities and project spending. Increased income could be spent on better food, clothing, and housing. Those employed on the Project might also get to know other people who could have a positive effect on behaviours related to health and safety. (Mackenzie Gas Project 2004b: 20)

In this view, human suffering in Dene communities is tied to a lack of opportunities to become fully involved in modern capitalism. The Mackenzie Gas Project promised to provide such opportunities and, by extension, to propel Dene people into a better future. It suggested that if only Dene people could become involved in capital accumulation and consumption (modeled by others who they would encounter on the worksite), the suffering experienced by Dene peoples would be remedied. Yet suffering as described in the above narrative is immediately disarticulated from colonial structures of domination that have worked, both in the past and at present, to characterize Indigenous peoples as unable to cope with modernity so as to justify ongoing dispossession and assimilation.

Of course, colonial injustices are not just historical; they involve past *and* present configurations of policy and law, ideology and power. The historicization of colonial injustice not only distorts connections between past and present but also gives the illusion that these injustices can be remedied through processes of recognition and reconciliation—or, in this case, participation in petrocapitalism. Throughout my time in the Sahtu, people described the suffering that they endured (and continue to endure) as a result of colonial incursions that inform and influence their lived experiences. These incursions were not the result of an inevitable march toward modernization; they were and continue to be the result of human choices and state policy. Forced relocations, harvesting restrictions, residential schools, the influx of disease, policies of removal, and the effects of past extractive industries are perceived not only as past events in time but also as forces that reverberate intensely in the present.

Though the written environmental impact statement served to contain narratives of the past to historical wrongs that could not be undone, the regulatory hearings were replete with painful and emotional stories offered by Dene people who have experienced historical and contemporary colonial processes. The politics of containment within the written text of the regulatory documents contrasted sharply with an exegesis of affect at the hearings, as Dene people tried to explain

to corporate elites, lawyers, and regulators how and why their experiences matter. Yet, while Dene people were given time to speak to the pain and human suffering of colonial violence, these affects did not register outside of the hearing-spaces: they were outside of the mandate of the regulatory review and thus could not be included in the final report or recommendations, and corporations repeatedly commented that addressing historical wrongs was the purview of governments, not private industry. At the hearings, the Dene participants expressed their pain and requested empathy while the industry and regulatory participants sat docile, passively receiving and refracting a surplus of history and of pain. That Dene people had to explain that their historical and ongoing suffering matters represents the abstractive tendency of the regulatory process: the idea that historical colonialisms can be disassociated from Dene presents and futures is central to the work of abstraction, as is the symbolic (rather than substantive) weight given to Dene experiences and voices.

Yet even as people described their suffering at the hands of colonial violence, practices of survivance (see Vizenor 2008) were also part of everyday experience. They were understood to be present when people told their stories, spoke their language, and perhaps most crucially, when they were on the land. As Caroline Yukon described to the Joint Review Panel in the community of Déline:

> When we are all together, when we're out on the land, we don't think of nothing. We don't think about our jobs. We don't think about our community. We don't think about paying our bills. The scenery is so beautiful out there, and that's why we love our land so much. We don't want anybody to take it away from us.[6]

In contrast to the dire picture of "baseline conditions" often described by project proponents, when Dene people talked about their lives, they expressed love and strength. Dene people did not tie their ability to live well to capital accumulation, but rather to their faith that their land would provide everything they needed. As Dolphus Tutcho explained:

> They believe very strongly about their creator, the creator that have supplied the Dene people with all the animals, the food, the fish, everything that you need. They didn't need the—no plastic money. And they did survive . . . that was their money in the bank. And they were happy. Even though they were very, very, poor, they were happy.[7]

The experiences described by many Dene people during the regulatory hearings were marked by the impact of colonialism, to be sure,

but also by the continued importance of their connection to their lands. In this way, they could maintain a life that was good and worthwhile—a life that was distinctly Dene.

## Imagining Extractivist Futures

By their very nature, environmental impact assessments anticipate particular futures. Yet these predictions of the future are largely abstractions—representations based on culturally situated understandings of the kinds of worlds we are able to envision. For Mackenzie Gas Project proponents, the underlying rationale for why the pipeline should be built was an economic one: energy companies would, of course, realize the economic benefit of producing and exporting natural gas, but advocates argued that construction of the pipeline would also bring economic prosperity to the people of the North by providing predictable employment and the development of a Northern labor force. Both environmental impact documents and proponents' presentations at community hearings entailed imagining a better life for Indigenous peoples in the North through the creation of jobs and economic spinoffs that the pipeline would bring. In addition to ownership in the pipeline through the Aboriginal Pipeline Group, the project was predicted to create over eight thousand jobs directly related to pipeline activities, with provisions put in place for hiring Northern and Indigenous workers (Mackenzie Gas Project 2004a). The project was also expected to create various spinoff businesses such as camp catering, transportation, slashing, and construction. The Mackenzie Gas Project was thus presented as an opportunity for Northerners—and Indigenous peoples in particular—to reduce their dependence on public-sector jobs and subsidies and to gain meaningful employment in private industry.

It was not only energy companies that would benefit from the construction of pipeline infrastructure in the North; governments, too, would see increased revenue through personal and corporate income taxes (and, in the case of the federal government, through resource royalties). Canada's federal government made no secret of its desire to see the Mackenzie Gas Project approved. In a 2006 report on the implementation of the regulatory process for the project, the federal government stated:

> Although the pipeline itself will bring economic benefits to Canada, of equal importance is that the transportation infrastructure will spur continued exploration and development of the 82 trillion cubic feet of remaining

> recoverable natural gas resources located in the Northwest Territories, northern Yukon, and Beaufort Sea . . . . In recognition of the significant contribution of oil and gas exploration and development activities to creating economic benefits, contributing to strong and healthy Aboriginal and northern communities and opening up a new frontier energy supply region, the Government of Canada is contributing capacity funds . . . to strengthen the government's scientific expertise, to support Northerners' participation in the environmental assessment and regulatory process and their ability to take advantage of economic opportunities. (Aboriginal Affairs and Northern Development Canada 2006)

Hence, the project was marketed not only as good for the North but as generating economic benefits at a national scale.

In reality, the Mackenzie Gas Project alone could not achieve the promise of economic prosperity described by industry and government advocates. A vast majority of the jobs generated as a result of the Project would last only for the two- to three-year period when the pipeline was to be constructed; the actual operation of the pipeline could be done remotely from the South and direct employment during long-term operations would be much lower.[8] Revenue generation for the Aboriginal Pipeline Group was also to be dependent on its ability to ship gas from future natural gas production. That is, the multinational energy companies that would operate the anchor fields—Imperial Oil, Exxon, Conoco Phillips, and Shell—would ship "their" gas based on their proportional ownership of the pipeline, while in order to generate revenue, the Aboriginal Pipeline Group would have to seek out additional gas producers to ship gas through its respective proportion of the pipe. This, of course, would require additional natural gas exploration and production in the region. In short, real, long-term economic opportunities for the North would only come from the further intensification of hydrocarbon extraction.

Yet, although the rhetoric used by energy companies and governments to justify the project and its design anticipated expanded hydrocarbon extraction as a consequence of building the pipeline, any consideration of how these future developments would transform Northern lands and Indigenous lifeways remained outside the scope of the regulatory review. In the community of Colville Lake, for example, when questioned about whether or not the pipeline would open the door for future hydrocarbon extraction, Imperial Oil's representative responded:

> With respect to other developments, there may well and likely will be other companies who will want to develop natural gas, including in this region,

> and to transport that gas through the Mackenzie Valley Pipeline. For us to do an assessment of it, we need to know if that gas would be developed, where it would be developed, and how it would be developed. And so when we did our assessment, we didn't have an understanding of that, and I would say we still don't have an understanding of that . . . yes, I think other companies will look for natural gas, but we didn't have information to assess it.[9]

The inability of the regulatory review to consider the scope of future hydrocarbon extraction meant that concerns expressed by Dene participants about the scale and extent of future extraction could not be considered by regulators in any concrete way. The temporal containment of the regulatory review thus served to disentangle the plan at hand for a pipeline through the Mackenzie Valley from the massive transformations that would come with the intensification of hydrocarbon extraction.

Economic dependence on petrocapitalism was exactly the kind of future that many Dene in the Central Mackenzie Valley wanted to avoid. Though participants in the regulatory process articulated that they want their young people to have opportunities for employment and that they likewise want to be equitable partners in any extractive activities undertaken in their territories, they were also clear that they did not want economic opportunities to come at the expense of the land. As Leroy Andre, President of the Déline Land Corporation, said to the Joint Review Panel at the hearings in Déline:

> There's not much mention about our culture when we talk about this pipeline. I want to make sure that we can have a balance when it comes to development and protecting our way of life in the North here. I want to make sure that we can find ways to make sure we do that. There has been a lot of money put aside for business opportunities, a socioeconomic fund that was talked about a few years ago. But to this date, I have not seen or heard of any money to help us protect our culture. We have fourteen students this year that are going to graduate from high school, and I want to make sure that these kids aren't forced to go down one path, which is a wage economy. I am very concerned because my son is going to school. He loves the traditional way of life. He loves the land, the hunting, the harvesting, the stories, the sacred sites that we have on our land. Great Bear Lake is one of the best places to live.[10]

Not only did Dene participants articulate concerns about the intensification of hydrocarbon extraction on a regional scale, they also called attention to the global consequences of dependency on fossil fuels. They expressed concerns that the natural gas would go to oil

sands refineries in Northern Alberta, facilities that were perceived by Dene people living along the Mackenzie River as already contributing to degraded water quality. Participants also talked about how the Mackenzie Gas Project would contribute to greenhouse gas emissions during the construction of the pipeline and when the gas was used by consumers downstream, thus contributing to climate change.[11] At the heart of these concerns was a reordering of the relationship between humans and nature that extractivism requires, as well as the morality of continued intensive exploitation of nature for profit at the expense of a livable Earth. Charlie Neyelle, an elder from Déline, made these points poignantly before the Joint Review Panel at the hearings in Déline. After talking at length about the nature of appropriate human–animal relationships maintained by Dene people, Neyelle asked Imperial Oil:

> What I'm saying is that if the oil company are really addicted to the oil, is there any way they can deal with it and solve the problem? I'm just asking that question. Is there some way that you can solve the problem with addiction with the oil, the pipeline, the natural gas? How are you going to heal the animals, heal the land? How are you going to heal yourself? How are you going to heal the moose and the land and the tree? Is there any—anything that can solve and heal the addiction of the oil?[12]

In response to Neyelle's question, Randy Ottenbreit, a development executive for Imperial Oil, replied:

> I think the only comment I would make is [that] the reason why people produce natural gas or oil is because it's used for things that people want. I noticed the Ski-Doos that are driving around town use fuel. The electricity in this building comes from a generator that uses diesel, and we came here today on an airplane that uses jet fuel. And so we produce products that people like to use because of the ability to travel, to heat their houses, to light their houses, and so that's the reason why petroleum products and natural gas products get used.[13]

The implication of Ottenbreit's response is that Dene people are also dependent on fossil fuels, that they too are consumers of energy and participants in ways of life that necessitate further hydrocarbon extraction. What this statement fails to take into account is that dependency on fossil fuels is the product of particular arrangements of political, social, and economic power. Responsibilities for massive, human-induced environmental change at a planetary scale are uneven, as are the consequences (Klein 2015; A. Moore 2015). The implication that Dene people are commensurate contributors to and beneficiaries

of such extractivism not only belies the uneven distribution of material benefits and ecological risks that would result from the Mackenzie Gas Project, but also eschews the wider national and transnational flows of capital and power that underpin these processes.

## Foundation for a Sustainable Northern Future?

In his work on social impact assessment in the oil sands region of Northern Alberta, the anthropologist Clinton Westman has argued that environmental impact assessment documents work not only to *de*scribe, but also to *in*scribe the future. In Westman's account:

> The production of impact assessment documents as scenarios of the future is a creative undertaking, drawing on existing knowledge, hopes, and fears. The practice of impact assessment is, in turn, related to planning and the concept of opportunity costs. At the root of these discussions lie differentials in power: power to tell the story of the future and then to enact it. (2013: 112)

Certainly, the notion of opportunity costs loomed large in the assessment of the Mackenzie Gas Project. In its rationale for why the project should be built, Imperial Oil explained that "economic conditions for development of Northern gas fields appear favorable, supported by natural gas supply and market demand" (Mackenzie Gas Project 2004b: 2). Energy companies and governments also raised concerns about impending competing pipelines such as the Alaska Natural Gas Pipeline; if approval was delayed for the Mackenzie Gas Project, the Alaska pipeline could drive up costs due to competition for steel and labor (Whitney and Behrens 2010). Indeed, it was widely assumed that there was no room for two pipelines in the North. The story of the future told by pipeline proponents was that if a better future for the North was to be realized, then the pipeline must be built—and it must be built now.

Dene participants in the regulatory process contested the immediacy and urgency of project approval. Over and over, they stressed the need to take time to make sure that a pipeline through the Mackenzie Valley was the right course of action; it was "something big and important" that people needed to sit down and discuss together in order to make the right decision.[14] As chief of the community of Tulit'a, Frank Andrew told the Joint Review Panel: "We are talking about something big. Our people are saying to slow down."[15] The story of the future that Dene participants articulated at the community hear-

ings was one of reluctant hope that this project might be different from colonial incursions of the past, but also a fear that the land—and their way of life as Dene people—would be obliterated by the intensification of petrocapitalism.

Ultimately, regulators made their assessment of the pipeline based on what they could consider: how the project as filed might affect current "baseline conditions," but not how these conditions were tied to histories of dispossession, harms of previous extractive industries, or colonial policies of assimilation. They examined short-term impacts of the project as filed on the ecologies and communities of the North, but not how it might contribute to global dependence on fossil fuels and the consequent relations of production and subjectification that comes with extractive economies. And, owing to the scope of their mandate, they could not assess the changes that future hydrocarbon extraction, though widely anticipated, would bring to the ecologies and lifeways of people in the North. The abstraction and obfuscation of temporalities that were thus bracketed in the regulatory review made its conclusions all the more possible, as did instruments of recognition that situated Indigenous peoples as partners in the project—as makers of their own futures—without attending to the uneven distribution of benefits and the true nature of the costs.

In the end, the creation of a new hydrocarbon frontier in the Northwest Territories was not to be realized. Some Northerners, such as Northwest Territories legislator Kevin O'Reilly, suggested that the regulatory delay may have been a "godsend" (Strong 2017). Had the pipeline been built, people in the North might have been left with a fragmented landscape or saddled with debt and a half-completed project as hungry energy companies moved their investments to other futures, to other imagined frontiers.

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## Notes

1. Extractive projects including the Port Radium Uranium mine, the Imperial Oil fields and refinery at Norman Wells, and the Canol Pipeline were undertaken on Dene lands in the Central Mackenzie Valley, all with the financial and/or political support of the state. Some Dene men, mostly from what is now the community of Déline, were employed at Port Radium as casual laborers carrying bags of raw uranium ore from the mine to the transport ships across Great Bear Lake. Sahtu Dene men also carried burlap sacks of uranium ore around the rapids on the Great Bear River to be loaded onto Mackenzie River barges headed south to Port Hope, Ontario. While a report released by the Canada-Déline Uranium Table (2005) indicated that it was not possible to link the premature deaths of many of the ore carriers to radiation exposure, many people in Déline believe that exposure to the ore resulted in high rates of cancer among these men, who were never informed about the potential health effects of handling radioactive material. The same report maintains that the estimated 740,000 tons of tailings dumped in and around the lake at the Port Radium site were localized and could not have affected the health of people in Déline. Fears over contamination and illness as a result of Port Radium continue to cause a great deal of concern among community members. In 2005, some seventy-five years after uranium was first mined out of Port Radium, the federal government agreed to remediate the Port Radium site and to implement a long-term monitoring program.
2. The federal government's comprehensive land claims policy was articulated in its 1973 Statement of Claims of Indian and Inuit People.
3. Indigenous peoples in the Dehcho Region did not ratify a comprehensive land claim and have argued that, as a result, they were not given adequate representation on the Joint Review Panel for the Mackenzie Gas Project, even though 40 percent of the pipeline route runs through their territories. Dehcho First Nations were also not members of the Aboriginal Pipeline Group, which represented three Indigenous groups (the Inuvialuit, Gwich'in, and Sahtu), who did have comprehensive land claims in place.
4. The Aboriginal Pipeline Group held an ownership stake in the pipeline only, not in the anchor fields. Thus, revenues for the Aboriginal Pipeline Group would grow with pipeline volumes. For example, a 33 percent ownership would be realized only if the shipment of gas through the pipeline increased in volume to more than four hundred million cubic feet per day. If the volume did not increase, the Aboriginal Pipeline Group would own only a 3 percent share. Additionally, any profits initially generated by the Aboriginal Pipeline

Group from pipeline tolls would be used to repay the loan from TransCanada and would not be transferred to shareholders.

5. In 2007, the Federal Minister of Indian Affairs and Northern Development commissioned then chairman of the Alberta Energy and Utilities Board Neil McCrank to prepare a report assessing the efficacy of regulatory systems in the territorial North. McCrank's report suggested that these systems lacked neutrality and adequate capacity to meet the objectives of an effective and efficient regulatory system. McCrank (2008: 13) recognized the influence of Indigenous peoples on resource management in the North, but suggested that this influence must be recognized in a "practical way."
6. Caroline Yukon, Joint Review Panel Hearing Transcripts, 3 April 2006, vol. 16, 1639.
7. Dolphus Tutcho, Joint Review Panel Hearing Transcripts, 3 April 2006, vol. 16, 1684.
8. The Environmental Impact Statement for the Mackenzie Gas Project predicted a peak of 8,740 jobs created as a result of the anchor field and pipeline activities during project construction. After construction was complete, a total of 694 jobs were predicted, 253 of which were related to anchor field drilling and construction (Mackenzie Gas Project 2004b: 17).
9. Randy Ottenbreit, Joint Review Panel Hearing Transcripts, 10 April 2006, vol. 21, 1977.
10. Leroy Andre, Joint Review Panel Hearing Transcripts, 3 April 2006, vol. 16, 1618.
11. A report by the Pembina Institute (2007) and submitted to the Joint Review Panel for the Mackenzie Gas Project considered four different scenarios for how natural gas produced by the Mackenzie Gas Project would be used. The report found that greenhouse gas emissions could amount to as much as four times more than the amount predicted in the Project's environmental impact statement.
12. Charlie Neyelle, Joint Review Panel Hearing Transcripts, 3 April 2006, vol. 16, 1645.
13. Randy Ottenbreit, Joint Review Panel Hearing Transcripts, 3 April 2006, vol. 16, 1646.
14. Mr. Etchinelle, Joint Review Panel Hearing Transcripts, 4 April 2006, vol. 17, 1771.
15. Chief Frank Andrew, Joint Review Panel Hearing Transcripts, 4 April 2006, vol. 17, 1738.

## References

Aboriginal Affairs and Northern Development Canada. 2006. "Mackenzie Gas Project (MGP) and Induced Oil and Gas Exploration and Development Activities in the Northwest Territories." Report on Plans and Priorities. Minister of Public Works and Government Services Canada (Ottawa).

Appel, Hannah. 2018. "Infrastructural Time." In *The Promise of Infrastructure*, edited by Nikhil Anand, Akhil Gupta, and Hannah Appel, 41–61. Durham, NC: Duke University Press.

Blackburn, Carole. 2005. "Searching for Guarantees in the Midst of Uncertainty: Negotiating Aboriginal Rights and Title in British Columbia." *American Anthropologist* 107(4): 586–96.

Canada-Déline Uranium Table. 2005. *The Canada Déline Uranium Table Final Report Concerning Health and Environmental Issues Related to the Port Radium Mine*. Ottawa: Indian and Northern Affairs Canada.

Coulthard, Glen Sean. 2014. *Red Skin, White Masks: Rejecting the Colonial Politics of Recognition*. Minneapolis: University of Minnesota Press.

Dokis, Carly A. 2015. *Where the Rivers Meet: Pipelines, Participatory Resource Management, and Aboriginal–State Relations in the Northwest Territories*. Vancouver: UBC Press.

Irlbacher-Fox, Stephanie. 2009. *Finding Dahshaa: Self-Government, Social Suffering, and Aboriginal Policy in Canada.* Vancouver: UBC Press.

Jones, Jeffrey. 2017. "End of Arctic Pipeline Leaves Indigenous Promise Unfulfilled." *Globe and Mail*, 28 December. https://www.theglobeandmail.com/report-on-business/rob-commentary/end-of-arctic-pipeline-leaves-indigenous-promise-unfulfilled/article37450536.

Junka-Aikio, Laura, and Catalina Cortes-Severino. 2017. "Cultural Studies of Extraction." *Cultural Studies* 31(2–3): 175–84.

Klein, Naomi. 2015. "Foreword." In *Unsettling Canada: A National Wake-Up Call*, by Arthur Manuel and Grand Chief Ronald M. Derrickson, ix-xii. Toronto: Between the Lines.

Larkin, Brian. 2018. "Promising Forms: The Political Aesthetics of Infrastructure." In *The Promise of Infrastructure*, edited by Nikhil Anand, Akhil Gupta, and Hannah Appel, 175–202. Durham, NC: Duke University Press.

Mackenzie Gas Project. 2004a. "Environmental Impact Statement for the Mackenzie Gas Project." 8 vols. Submitted by Imperial Oil on behalf of the Mackenzie Gas Project Proponents to the National Energy Board.

———. 2004b. "Environmental Impact Statement in Brief." Prepared by Imperial Oil on behalf of the Mackenzie Gas Project Proponents.

McCrank, Neil. 2008. *Road to Improvement: The Review of the Regulatory Systems across the North.* Ottawa: Minister of Public Works and Government Services, Canada.

Moore, Amelia. 2015. "Anthropocene Anthropology: Reconceptualizing Contemporary Global Change." *Journal of the Royal Anthropological Institute* 22(1): 27–46.

National Energy Board. 2010. *Respecting All Voices: Our Journey to a Decision*. Ottawa: National Energy Board, Canada.

Pembina Institute. 2007. *Mackenzie Gas Project Greenhouse Gas Analysis—An Update*, 3rd ed. Drayton Valley, AB: Pembina Institute.

Peyton, Jonathan, and Arn Keeling. 2017. "Extractivism and Canada 150." *Historical Geography* 45: 117–24.

Reynaud, Anne-Marie. 2014. "Dealing with Difficult Emotions: Anger at the Truth and Reconciliation Commission of Canada." *Anthropologica* 56(2): 369–82.

Strong, Walter. 2017. "Mackenzie Valley Pipeline Project Officially One for the History Books." *CBC*, 28 December. https://www.cbc.ca/news/canada/north/mackenzie-valley-gas-project-no-more-1.4465997.

Szeman, Imre. 2017. "On the Politics of Extraction." *Cultural Studies* 31(2–3): 440–47.

Veltmeyer, Henry, and James Petras. 2014. "Introduction." In *The New Extractivism: A Post-Neoliberal Development Model or Imperialism of the Twenty-First Century?*, edited by Henry Veltmeyer and James Petras, 1–22. London: Zed Books.

Vizenor, Gerald. 2008. "Aesthetics of Survivance: Literary Theory and Practice." In *Survivance: Narratives of Native Presence*, edited by Gerald Vizenor, 1–24. Lincoln: University of Nebraska Press.

Watts, Michael. 2004. "Resource Curse? Governmentality, Oil, and Power in the Niger Delta, Nigeria." *Geopolitics* 9(1): 50–80.

Westman, Clinton. 2013. "Social Impact Assessment and the Anthropology of the Future in Canada's Tar Sands." *Human Organization* 72(2): 111–20.

Whitney, Gene, and Carl Behrens. 2010. *Energy: Natural Gas*. Alexandria: The Capitol.Net.

CHAPTER 7

# Material Unconscious of the Earth

## *Extractive Ontology and the Invisible War in Siberia*

Oxana Timofeeva

This chapter is an attempt to bring together some perhaps not so obvious theoretical stakes with some perhaps not so well-known empirical data in order to turn inside-out our conceptions of the exploitation of human and natural resources. I take a philosophical perspective, insofar as not only *our* but *everyone's* and *everything's* well-being—or, to be precise, not-so-well-being—is concerned. One might call it a new materialist approach to extractive economic processes, as it is within new materialism's agenda to merge ontology with ecology and to interrogate an irreducible nature of nature (e.g., Barad 2007; Bennett 2010; Coole and Frost 2010). But it is also new in an older, dialectical sense suggested by Karl Marx ([1888] 1983) in his "Theses on Feuerbach," as it neither considers matter as an object or contemplation (even if vibrant, agentive, or alive), nor prefers substance over subject in an attempt to exclude a human observer from the picture of a material universe. Rather, this approach is oriented toward sensual human activity and practice as inalienable from the life of matter. My ambition is to outline a kind of social ontology of extraction, where the human and the nonhuman are entangled, and political ecology is inseparable from political economy.

I begin with some notes on our modern understanding of nature as a repository of resources that might be finite or infinite, and by

sketching a scheme of setting them on fire for the sake of energy that is symbolized by the mythical figure of the phoenix. I then consider oil extraction and combustion across several dimensions: as the process of abstraction, or transforming something material (like oil and labor) into the immaterial but nevertheless real (like capital or commodity); as the process of repression (both in geological and psychoanalytic senses); as the processes of oppression and exploitation of living and nonliving entities, and, finally, as warfare and myth. Touching on literary texts, sociopolitical realities, and my own experience as a child learning about the nature of oil in Western Siberia, I focus in the end on a small, disappearing, nomadic nation of reindeer breeders, Surgut Khanty, and their invisible war against the machine of extraction. This tiny group of Indigenous people in present-day Siberia set their animist cosmology and their traditional ways of living sustainably in the North in opposition to the ecological catastrophe brought by technological developments. They are, as a result, the ones who really take ecology in the region seriously, as their very existence is incompatible with the catastrophic developments of oil extraction.

The problem of extraction evokes a question that does not have a true answer: how much can we take from nature? Can it provide enough resources to satisfy the needs of humankind forever, or is it in danger of being completely exhausted, used up? Answering these questions, I suggest, demands contending with a paradox introduced by Ovid (1922) in the *Metamorphoses*. Ovid recounts the legend of Baucis and Philemon, which originates in Greek and Roman mythology. In order to test the humanity of mortals, two gods, Jupiter and Mercury, come down to Earth disguised as strangers. They go from one house to another and knock on a thousand doors, but each time they are turned away: no one recognizes them in their beggarly guise. Finally, an old, poor couple, Baucis and Philemon, opens the door of their small cottage to these strangers. They do not have much to offer, but they welcome the guests with sincere hospitality, serving a modest dinner of fruits, vegetables, and eggs. They also serve some wine, and suddenly a miracle happens: they pour from the bowl, but it fills itself up with wine again and again. Thus the hospitable couple realizes that their guests are not mere mortals:

> But while they served, the wine-bowl often drained,
> as often was replenished, though unfilled,
> and Baucis and Philemon, full of fear,
> as they observed the wine spontaneous well,

> increasing when it should diminish, raised
> their hands in supplication, and implored
> indulgence for their simple home and fare.

Michel Serres (2007) cites this story, along with other ancient fables, in *The Parasite*, where he describes the entire system of the world economy in terms of parasitism. The parasite lives at the expense of the other, who is called the host; it attaches itself to the body of the host or digs inside of it and eats it. Thus, a host provides a parasite with both home and nourishment. A parasitic relation is not mutual, not one of exchange, since a parasite does not give anything back to the host. Yet the parasite itself can become a host for another parasite. All living beings including humans, for Serres, are assembled into a complex parasitic chain. The ultimate and universal host is nature, on whose body we lodge ourselves and whose resources miraculously never end. Nature is the last (or the first) link of a universal parasitic chain; it does not parasite anything but can only host. Baucis and Philemon appear as generous hosts, ready to freely share everything they have. But even if the host's resources are limited, they are never entirely depleted—or, better, they are drawn again and again from the depletion and exhaustion of the host. This is what Serres (2007: 99) calls the "daily miracle of the parasite." Here, Serres evokes the image of the phoenix, a bird that burns itself and then reappears out of its own ashes:

> It is always the *table d'hôte* and the phoenix of the hosts. Parasitism doesn't stop. The host repeatedly is reborn from his ashes, from the ashes expelled through the stercoral door. Sit down at the *table d'hôte*; the host always makes the meal. He is there for that. The host is reborn from his consumption, from his consumption by fire, and the wine springs again from his destruction. (Serres 2007: 99)

Long before Serres, the figure of the phoenix was introduced in a similar sense by G. W. F. Hegel, who, in the closing paragraphs of his *Philosophy of Nature*, presents the aim of nature as death of its own accord or self-annihilation for the sake of spirit:

> The purpose of nature is to extinguish itself, and to break through its rind of immediate and sensuous being, to consume itself like a phoenix in order to emerge from this externality rejuvenated as spirit. ([1830] 1970: 444)

The phoenix sacrifices itself or, as Hegel puts it, consumes itself, but always awakens anew. Our spiritual universe thus knows nature as

an undead body, whose miraculous hospitality has no limit. At least, such is the modern idea of nature conceived as a kind of gigantic storehouse that exists in order to provide us with whatever we need, from food and heat to love and wisdom. The figure of the phoenix transforms its exhaustion into a source of a new life, thus enacting a circular logic of consumption.

A special role in this mythic structure is accorded to fire: fire is what transforms the phoenix or, here, nature, into something spiritual. Behind Hegel's metaphorical fire is the elemental medium of the sacrifice: spiritual content that, in traditional sacrificial rites, belongs to gods must be extracted from material forms by being given over to the flames. Fire thus serves as a kind of vehicle that transforms the material into the spiritual. As Michael Marder argues, this ancient machine of spiritualization has not ceased to set the world on fire:

> In the twenty-first century, the myth of the phoenix continues to bewitch us. We still think of ashes as facilitators of new life, nourishing renewed growth. After the destructive flames have done their work, the creative blaze of the sun will give a sign of resurrection to the plants it will call forth from the residue of past burning. Between the two fires life (and hope) will resume. Vegetation will erect itself from the earth, striving towards the sky afresh. In its vegetal configuration, the "phoenix complex" underpins the destruction of the Amazonian jungle, where slash-and-burn agriculture aims to convert dense forests into fertile farmland. . . . Much of the same happens on a global scale, with governments and individuals disregarding the disastrous implications of the planetary burnout and putting their blind trust in the environment's ability to rejuvenate again. (2015: 155)

Today's name for this circle of natural hospitality is energy: the materiality of nature is considered as its "temporary repository" (Marder 2015: 93), and the phoenix that is constantly burned up consists of fossil fuels. If we try to think outside of an anthropocentric framework, we have to start from the fact that not only so-called human resources (or, in Marx's terms, living labor) are burned up in the accelerating race of production: natural resources as an undead, nonhuman material agency are also widely exploited. The Earth is the host to which capital parasitically attaches itself, according to its extractive character.

Coal mines, oil wells, and the like are the holes it digs in order to retrieve ancient substances from the subsoil and make them burn. Khanty, the Indigenous people that inhabit the northern parts of Siberia, see this process as inflicting wounds on the Earth, which they call God or "the sitting one" and whose name they only pronounce on rare

occasions, at celebrations or when one is in trouble. Thus, Jeremy Aypin (2016: 76), a famous Khanty writer, recalls his mother telling him that every living being has a soul—"a tree, a little blade of grass, a flower." The Earth as God and, therefore, a living being has a soul and can also feel pain. That is why, as Aypin writes, his parents were always trying to heal the wounds of the Earth when, for example, they let an axe fall on the ground.

In contrast to this animist perspective, modern technoscience does not see souls in nature but is focused on the way of getting energy out of inert matter. As Brent Ryan Bellamy and Jeff Diamanti (2018) argue, a theory of the conservation of energy according to which energy can neither be created nor destroyed but only transformed is immanent to capitalist modernity, in which the Nietzschean idea of the eternal return appears as its metaphysical double. An eternal return of energy (or the rebirth of the phoenix) creates a paradigm whose function is to immunize the world against a sense of ecological and social catastrophe.

Michael Marder, in turn, develops his own critique of energy in reference to the nineteenth-century *Naturphilosophie* of Friedrich Schelling, who "makes the process of combustion central to the existence of every organic and inorganic terrestrial entity" (Marder 2015: 93). Schelling states that "no substance on the Earth can come to light which was not either combusted or would be combusted, or was not combustible" (Marder 2015: 94). From this way of thinking about nature, Marder draws far-reaching consequences:

> The tragedy of the twenty-first century is that we have taken it upon ourselves to actualize this potentiality and to burn everything that is combustible, including, at some level, ourselves. It is incontrovertible that the extraction of energy by burning things predates not only our epoch but industrial modernity as well. But there is a veritable abyss between the fires kindled with a few branches in a prehistoric cave, the coal burnt in the English factories of the eighteenth century, and the contemporary combustion of biofuels. The early representatives of humankind set a small bit of the present or immediate past alight; rapidly industrializing Europe submitted the deep past of vegetal and animal life to fire; today's blaze bears a total character, where the past, the present, and the future burn together in a process that is indistinguishable from incinerated life, from its production and reproduction for the sake of being consumed as energy. (2015: 95)

The extractive industry, with its total dependence on the burning of the phoenix, has pointed capitalist development toward a serious col-

lision between the global economy and global ecology, which promises to have catastrophic side effects. Yet this trajectory also has a very specific ontological structure, in that it affects not only the social and natural world but also being itself, that is, the way things are. One of this ontology's key elements is abstraction, by which the process of extraction is realized. What we (people and machines) extract is not only combustible but also essential, material, consumable in the broadest sense. In the process of capitalist extraction, this concrete materiality is parasitized by an abstract value form. Capitalizing nature thus functions within the same logic of sacrifice as fire, with profits as the spiritual component extracted from materiality.

Our modern disposition is such that a value-form bounds all of existence and can be attached to any piece of living, nonliving, dead, or undead matter. This gives us a first insight into the phenomenal analysis of oil as a resource for both extractive and abstractive industry. The capitalist world consists of commodities and, among them, there is one for which all other commodities can be exchanged: that is, money. Money is both abstract and real; it is a real abstraction that, even if it does not really exist, produces effects.

However, this is not the whole of the economic structure of humanity. The truth is that money is neither an ultimate commodity nor an autonomous being. There is always something else, another element to which money clings in order to prove that it is real. It is precisely this extra element that prevents the world's closure within real abstraction. The material excessiveness of capital is what opens this world as a not-all, what reveals the impossibility of the general equivalent. In olden times, it was gold that played this role; today, oil has taken its place. Extraction of oil from the depths implies its total capitalization and thus abstraction, but the substance's excessive appearances as spills or flares create ruptures in the fabric of this abstraction. What these ruptures reveal is not an objective reality beyond capital, but rather its material unconscious. An oil spill or a gas flare are both uncanny, in a Freudian sense, and sublime, in a Schellingian one: in both cases, that which ought to remain secret is suddenly brought to light. A flux of crude oil on the surface of the earth produces an effect like that of a flux of blood from a wound. The Khanty folklorist Elena Ermakova draws on this imagery:

> They chained her breast with iron,
> They thrust sharp spears right in her liver,
> They pump her blood,
> Sell it and grow rich. (2016: 216)

This comparison of oil to blood brings us to a persistent moment of petromodernity, which is echoed in recent historical events. "Kazakhstan oil contains the blood of workers," went the slogan about the tragedy in Zhanaozen, a small town in the Mangystau region of Kazakhstan. Zhanaozen is a steppe settlement with harsh climatic and ecological conditions. Nothing grows there because of the heat, only a dust wind blows, and local people say that, after death, the sinners of Zhanaozen are sent back there again. The majority of the population works in the Ozenmunaigas oil field, which is operated by Kazakhstan's state oil company. In the spring of 2011, the workers found out that they were receiving less than half of their official salary. They initiated a strike that lasted for seven months, after which local authorities provoked confusion and fighting in the street that ended in a violent suppression and mass shooting. According to government officials, there were about fifteen deaths, but independent voices claimed that there were more than sixty. The Russian journalist Elena Kostjuchenko (2011, 2017) went to Zhanaozen twice: first right after the December 2011 tragedy, and then half a year later to find the graves. She did not succeed in identifying them, only seeing some mounds of sand at an abandoned Russian cemetery. But she reported that, according to rumors, some bodies were thrown into the oil wells.

The line of thinking that oil is a junction to blood is developed in the literary domain, for instance, by the contemporary Russian writer Viktor Pelevin. The protagonist of his novella *Macedonian Criticism of French Thought* (2009), the son of a rich oil baron, depicts his father as one who is drinking the blood of the earth. Then he learns from his schoolbooks that oil is not exactly blood, but something more like a combustible humus formed from the organisms that populated our planet in prehistoric times. The son is astonished by the idea that dinosaurs did not entirely vanish without a trace, but rather continue to exist as this black liquid that his father extracts from the earth.

I will admit that my first ideas about oil were of the same sort. When I was a child, my family lived in Surgut, one of the centers of the petroleum industry in the northwest of Siberia. As a schoolgirl, I learned that the oil was made of dinosaur bodies decomposing beneath the ground. On my way to school there was a shallow swamp. Each time I crossed it, I had the feeling that the ground was never really solid, not only here, but anywhere; it just covered this subterranean cemetery of enormous animals that inhabited the Earth long before us. I even believed that the dinosaurs might reemerge from the murk created by an oil spill, like the Loch Ness monster protruding from the water of a lake. Dialectically, I sensed that oil kept something of that organic life,

the death of which was its origin. The oil of my childhood was thus neither living nor dead, but a living dead, an undead or an uncanny and utterly inhuman afterlife.

When Pelevin's protagonist grows up and becomes a philosopher, he discovers the secret of money: according to his theory, capital is "humanoil," a kind of oil left behind by human beings after they die, just as if they were dinosaurs. Humanoil, or money, is the form in which human energy is posthumously conserved. The more people die, the more money grows. Is it surprising that, after so many years, I came to a similar conclusion? Pelevin's fiction aptly illustrates what I call the real abstraction that accompanies the process of extraction, or what Marx rendered as living labor sucked dry by the vampire of capital. Fossil fuel and alienated labor are industrial components of a postindustrial digital society in which they have supposedly been overcome, but in fact preserve themselves in a repressed form somewhere beneath the ground: oil between geological layers and labor in underground sweatshops, basements, bunkers, and tunnels where migrants and people from poor countries are exploited.

In his renowned *Cyclonopedia*, Reza Negarestani also touches on the comparison between oil and blood. In contrast to Pelevin, though, Negarestani (2008: 28) denounces our shared "myth of fossil fuels, according to which hydrocarbons constitute the origin of petroleum." He holds that advocates of this myth use the fact that both oil and blood contain organic compounds as "evidence of a common lineage." This hypothesis of biogenic origin maintains that oil was produced from the decomposition and fossilization of various ancient plants and animal organisms—if not dinosaurs per se, then zooplankton and algae. If this is the case, then the sources of oil are finite: once exhausted, they cannot be replenished, since the process of its formation lasted millions of years.

Negarestani (2008: 17) notes that "according to the classic theory of fossil fuels . . . petroleum was formed as a Tellurian entity under unimaginable pressure and heat in the absence of oxygen and between the strata, in absolute isolation," which, in his perspective, comprises "a typical Freudian Oedipal case." Contrary to this view, Negarestani (2008: 224) sketches a theory of the non-Oedipal inorganic unconscious, imagined as demons that "infiltrate an anthropomorphic agency" and "embed their inorganic sentience within the human host." Here, it is oil itself that acts as a parasite, and not the extractive industry that sucks it up. Negarestani inscribes oil in a kind of inhuman cosmic conspiracy that underlies planetary economy, geopolitics, and warfare.

Negarestani envisages war as a machine, or rather two machines connected by the agency of petroleum. On one side is Abrahamic monotheism, or jihad war, and on the other Technocapitalist war, or the War on Terror:

> To grasp war as a machine, or in other words, to inquire into the Abrahamic war machine in its relation to the Technocapitalist war machine, we must first realize which components allow Technocapitalism and Abrahamic monotheism to reciprocate at all, even on a synergistically hostile level. The answer is oil: War on Terror cannot be radically and technically grasped as a machine without consideration of the oil that greases its parts and recomposes its flows; such consideration must begin with the twilight of hydrocarbon and the very dawn of the Earth. (Negarestani 2008: 16–17)

For Negarestani, the nomadic horizontality of the desert is essential for the petroleum intrigues of the Middle East. But Russian oil mostly comes from the Siberian taiga, forest tundra, and tundra. In the region of Surgut, where I am from, there are forests and swamps. Although it does not lie within the Arctic circle, this territory is still considered to be the Far North. Russians settled it after the conquest of Siberia in the seventeenth century, but urban development as such started in the 1960s, when gigantic oil fields were discovered beneath the layers of permafrost. Geologists, oilmen, and builders arrived, and industrial cities started to spread in a region long populated by Indigenous nations such as the Khanty and Manci.

Some legislative protections were put in place to defend these nations with their unique cultures. Yet the extinction of their traditional ways of living—reindeer breeding, hunting, and fishing—seemed inevitable due to their incompatibility with the petroleum industry. Oil fields in the Far North replace reindeer feeds; oil spills poison rivers, forests, and swamps, making them unsuitable for reindeer or fish. The more that industry advances, the more that Indigenous people and their thinning herds retreat to the forest and tundra. "The north is infinite," a popular Soviet song goes, but in fact it is not. Today, Siberian Indigenous people are being pushed to the edge of the North. As Ermakova's poem laments:

> No more sun for the Khanty,
> No more life for the Khanty,
> No more place for the Khanty,
> Neither in Taiga nor in the wild Tundra! (2016: 216)

Indigenous resistance in Siberia is very local and rarely takes the form of war, although some Indigenous people do see the invasion of their lands in these terms. Occasionally, individuals declare their own war

against the invaders and reach for their gun. Such was the recent case of Sergey Kechimov, who, in September 2014, shot a dog that belonged to an oil worker. He did so because the dog (or another like it) killed one of his reindeer and injured another. For this, Kechimov was charged with criminal assault and, in the fall of 2016, he was convicted of threatening to kill some of the workers. As Maria Favorsky, a representative from Greenpeace, noted: "Locals see the charges as a blatant attempt by the oil industry to scare off Indigenous opposition to oil drilling, and to get rid of a man who literally stood in its way" (Lerner et al. 2017).

Sergey Kechimov is no ordinary man. He is a shaman and the guardian of Lake Imlor, a sacred Surgut Khanty site now surrounded by oil and gas infrastructure.

> Surviving on this native land in the middle of the Fedorovka oil field seems almost impossible for both reindeer and the Khanty people that herd them—the wood is impoverished, the moss is gone, and the little remaining pasture has long since been pressed to the ground by the wheels of vehicles crossing to and from extraction sites. With their land under threat and alternative job prospects negligible, the Khanty people have largely left Lake Imlor. And yet, Kechimov stays behind, claiming a sense of duty to protect the sacred site; a descendant of shamans, he refuses to betray his ancestors and their heritage. (Lerner et al. 2017)

Such a war looks very different from Negarestani's colliding machines in the deserts of the Middle East. Instead, this invisible war is waged by a shaman trying to keep the Earth from bleeding, to bind up the wounds inflicted by the drilling of wells. The land Kechimov is trying to defend is a natural reserve with swamps and rivers around the lake. It is no coincidence that this lake, worshipped by Khanty people, has become a last stronghold of the struggle: a big deposit of oil can be found right beneath the lake. Just as in my childish fantasies about the undead dinosaurs decomposing underfoot, the material unconscious of contemporary capitalism is literally beneath the sacred. These sites protect the unconscious of the earth from being extracted and abstracted, capitalized and combusted. So far, though, technocapitalism is winning the war, the meaning of which it will never understand.

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## References

Aypin, Jeremy. 2016. "Bol Zemli" [The Pain of the Earth]. In *Literaturnoe nasledie obskikh ugrov* [Literary Heritage of the Ob-Ugrians], Vol. 2, edited by E. V. Kosintseva, S. S. Denislamova, L. N. Panchenko, and L. A. Andreeva, 75–76. Izhevsk, Russia: OOO Print-2.

Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke University Press.

Bellamy, Brent Ryan, and Jeff Diamanti. 2018. "Phantasmagorias of Energy: Toward a Critical Theory of Energy and Economy." *Mediations* 31(2): 1–16.

Bennett, Jane. 2010. *Vibrant Matter: A Political Ecology of Things*. Durham, NC: Duke University Press.

Coole, Diana, and Samantha Frost, eds. 2010. *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press.

Ermakova, Elena N. 2016. "A Shaman's Prophecy." In *Literaturnoe nasledie obskikh ugrov* [Literary Heritage of the Ob-Ugrians], Vol. 2, edited by E. V. Kosintseva, S. S. Denislamova, L. N. Panchenko, and L. A. Andreeva, Izhevsk, Russia: OOO Print-2.

Hegel, G. W. F. (1830) 1970. *Philosophy of Nature*. Translated by A. V. Miller. New York: Oxford University Press.

Kostjuchenko, Elena. 2011. "Žanaozen." *Novaya gazeta*, 21 December. https://novayagazeta.ru/articles/2011/12/20/47465-zhanaozen.

———. 2017. "Nenapisannyk tekst iz Žanaozena" [An unwritten text from Zhanaozen]. *Batenka*, 28 December. https://batenka.ru/protection/war/zhanaozen.

Lerner, Alexis Monique, Victoria Koshurina, Olga Chistanova, and Angela Wheeler. 2017. "Mitigating the Risks of Resource Extraction for Industrial Actors and Northern Indigenous Peoples." *Arctic Review on Law and Politics*. Retrieved April 30, 2021, from https://arcticreview.no/index.php/arctic/article/download/659/1861?inline=1

Marder, Michael. 2015. *Pyropolitics: When the World Is Ablaze*. London: Rowman & Littlefield.

Marx, Karl. (1888) 1983. "Theses on Feuerbach." In *The Portable Karl Marx*, edited by Eugene Kamenka, 155–57.

Negarestani, Reza. 2008. *Cyclonopedia: Complicity With Anonymous Materials*. Melbourne: re.press.

Ovid. 1922. *Metamorphoses*. Translated by Brooks More. Boston: Cornhill.

Pelevin, Viktor. 2009. *Makedonskaya kritika frantsuzskoy mysli: povesti i rasskazy* [Macedonian criticism of French thought: tales and stories]. Moscow: Eksmo.
Serres, Michel. 2007. *The Parasite*. Translated by Lawrence R. Schehr. Minneapolis: University of Minnesota Press.

CHAPTER 8

# Representation without Resemblance

## *Graphical Expression in Hydrocarbon Industry*

Arthur Mason

This chapter introduces an energy visual type—*the graph*—whose popularity as an inscription device constitutes a style of hydrocarbon aesthetics that celebrates abstractness. Graphs enable cognition and provoke emotion through information transmitted by position of point, line, or area, on a two-dimensional surface. During the 2000s the graph became a key visual in attempts to commercialize Alaska natural gas resources. As an icon centered on Arctic hydrocarbon development the graph merits analysis as a form of representation that celebrates abstract expression.

Representation, according to Michel Foucault (2008, 1970), is a classification system that requires resemblance in three forms: first, representation is the work of resemblance whereby an original idea is transferred to a model; second, transferring the idea requires a technique of family resemblance, such as substitution (Ricoeur 1975: 173) and scaling (Tsing 2012), or extension (Almklov and Hepsø 2011) and imitation (Auerbach 1957: 104); finally, by presupposing a primary reference, representation affirms an original idea and thus creates hierarchies of less faithful copies struck from it (see Benjamin 1969).

Graphical representation, however, does not so readily align with resemblance. For example, given its primary reference is *the future*, how does the energy graph affirm an original that does not yet exist? Also, the graph's visual style favors an antirealist rupture of the picture plane and is therefore alien to the aim of resemblance. The graph

simply lacks any relatedness to an appearance of "family resemblance" through which the technique of resemblance can be linked (Wittgenstein 1956: §66; Monteiro, Jarulaitis, and Hepsø 2012). What then enables *the future* to be transferred to the graph?

Finally, *the future* itself is an abstraction while the graph is a sensorial image. Thus, moving from the abstract to the concrete raises the problem of whether the graph *usurps* the role of an original idea. The linguist Ferdinand De Saussure raises this concern when referring to representation through the vocal sign. He explains: "it is rather as if people believed that in order to find out what a person looks like it is better to study his photograph than his face" (1983: 28).[1] Not incidentally, the energy graph perpetuates hesitation. It's a visual that doesn't make a whole lot of sense on the surface of things and results in what Gadamer (1975: 78) calls an "agony of seeing." In sum: as a figure with only a curious connection to resemblance, how does the energy graph represent?

In what follows, I argue that the energy graph imposes a disciplined engagement with abstractness. Its introduction to Alaska energy politics is a material development in the form of a new social habitus of detachment. To make my argument, I offer two types of visual abstraction in Alaska hydrocarbon development. In the first example, I introduce the energy graph as an image lacking in simultaneous interpretation. I then turn to self-evident imagery available from news media (politicians and experts). I describe the differences in their respective styles—abstractness and self-evident—by reference to the social conditions of hydrocarbon development. In the case of the self-evident, the goal of development allows observers to be involved in events and to be drawn directly into its political rituals. For the graph, its abstractness imposes market understandings that emotionally detach from the concreteness of energy politics. The production of this combined "involvement and detachment" (Elias 1987) appears to confirm what Karl Marx noted about status and achievement in representation: in the political world "man always *appears* as the aim of production [whereas in capitalism,] production is the aim of man and wealth the aim of production" (1964, emphasis added).[2]

## Resemblance of the Energy Graph to Pictorial Art

On display in the graph are indicators said to correspond to the real. Similar to the *scale* mentioned by Marx—that allows the sugar-loaf and the iron to enter into a relation based on the expression of the weight of the other—the graph enables social values in hydrocarbon

development to both appear and be hidden. Andrew Barry (2013: 14) notes that such inscriptions, by themselves, provide little of the relations between companies, governments, or other stakeholders. They do not inform except in the most general way about the political economy of industry. As such, their social and economic order is conceived in "purified form" (Barry 2013: 104). In this way, the graph obliterates social relations through its visual classification scheme. But it also *officiates* relationships through its one-sided explanations.[3]

Nevertheless, the graph is more than an inscription device. It is a style of hydrocarbon aesthetics that celebrates abstractness. It is an abstract image that is analogous to, see below, the contemporary art image—the latter, a visual whose recognition reflects the consecration of an effort. Thus, the graph invites appreciation through an imposition of refinement. Pierre Bourdieu's (1984) regime of contrasting aesthetics—what he calls the Kantian and anti-Kantian aesthetic—offers one example of an imposition of refinement. As an analysis of taste, this regime functions to endow populations with separate ways of experiencing the world including distinguishing temporal distance.[4]

Among the energy sciences, visualizing through the graph is preoccupied with timelines that are inaccessible through direct human perception. Graphs that depict forecasts of liquid oil production, for example, are created from three distinct communities of practice: resource economics, petroleum geology, and energy and climate modeling (Farrell and Brandt 2006). Economists employ optimal depletion models aimed at determining levels of production and rate of depletion, thus identifying the maximum net present value of the resource. Petroleum geologists embrace the Hubbert methodology (Gaussian curve) assuming that oil extraction increases until the reservoir is half consumed, at which point production decreases. Finally, climate analysts are interested in oil production because of carbon dioxide emissions from oil use. Their efforts to simulate the extraction of oil are based on simplified non-specific petroleum resource bases. These approaches to the future are captured, plotted, and rendered through the graph. In other words, the graph is a readily acceptable visual in representing diverse activities that can transform information into knowledge that purports to have prognostic value.

Types of graphs used for visualizing energy information include linear, bar, and histograph. Image characteristics comprise color, texture, and edge style. These strong qualitative aspects draw attention to style classifications similar within the visual arts. The linear graph used in representing $CO_2$ emissions employs a spontaneity of unrestrained lines which is a visual technique resembling abstract Expres-

sionism with its reductionist color palette, vivid strokes, and lack of emphasis on form. By contrast, the bar graph focuses on geometric shapes that, arguably, could be associated with Minimalism with its anti-humanist rupture of the picture plane. Visuals of this sort suggest a lack of resemblance to pictorial art that typifies well-formed subjects such as those found in figurative historical art styles or scenes of delicately rendered landscapes. The use of qualitative attributes such as line, shape, and color suggest that the graph can provoke an aesthetic experience that disrupts its content of meaning (Rosato 2002).

The idea that the energy graph utilizes artistic form came to me when I happened to pass through the mezzanine floor en route to an energy roundtable inside the Corinthia Hotel in St. Petersburg, Russia. Executives attending the oil conference repeatedly walked past a set of hotel paintings whose color schemes and shapes struck a similarity with Arctic oil development graphs shown in an adjacent room. In one instance, the straight-line features of an oil painting mirror the block-shaped figures of a bar graph used to depict petrogeologic development futures in the Arctic. Placed side-by-side, the graph and the art painting seemingly collude in a form of representation whose visual resemblance gives no indication which is a primary reference. In a second painting from the hotel, a color palette of yellow and red creates a contrast between the particular and the general state of affairs. This painting mirrored an oil development image whose yellow/red contrast also gave a visual sensation of "seeing-in" (Budd 2008) on directional flows of ice in the oil-rich regions of the Barents Sea. In this instance, the energy graph is a visual representation whose model of resemblance is the artistic oil painting.

Thus, what appeared to me initially as images created to ensure reliability in planning came to suggest a social habitus through semantic provisioning. Faced repeatedly with oil graphs whose resemblance to abstract paintings seemed made to order (and vice versa), I began to wonder if the veracity of planning is a preference for abstract expression. In this instance, the graph is a type of visual whose primary resemblance is an art image—the latter, a representation whose recognition reflects a stress for achievement. Not to be ignored, the Corinthia is one of the more luxurious hotels in St. Petersburg. Its interior design—the selection of paintings, fixtures, and furniture—are original creations by the G.A. Group, a global hospitality specifier in London. In this setting, knowledge provisioning and incidental luxury become bound together, creating a link between aesthetics and credibility. Here, hotel extravagance enhances the possibilities of achieving knowledge acquisition whereby abstractness in artwork represents a

bid. Indeed, a substantial component of the allure of executive locations like the Corinthia is the way that they utilize space to "amplify and refine" an explicitly cosmopolitan identity (Levander and Guterl 2015: 6). In this way, the conception of abstractness in the graph is an aesthetic ideal that stands-in for the appearance of a hydrocarbon production ideal.

The historian Robert Brain (2015: 182–85) describes a similar pattern of representation wherein artwork is modeled from graphical expression. Brain points to the well-known painting *The Scream* by artist Edvard Munch. In this image, a linear waveform flows from the perspectival back of the painting onto the humanoid figure, drawing the viewer into the painting's landscape and soundscape. According to Brain, the painting deliberately sets the conditions of its visuality to resemble the graphical expressions of psychophysiological experiments, of which Munch was familiar at the time. *The Scream* is a visual representation whose model of resemblance includes the graph.

The resemblance between artwork and graphical expression offers an additional route for considering the graph by reference to Bourdieu's surface/depth dichotomy of taste. Bourdieu (1984) notes that perception is a process of interiorization of signs through pedagogic work by the individual. Such work produces a durable training of recognition or what he calls habitus. Largely through mapping differences between consumer goods onto differences between social groups, Bourdieu demonstrates that differences in habitus represent distinct cultural classification systems that appear as differences in taste. Arguably, the surface/depth dichotomy of the anti-Kantian/Kantian regime is a simplification; the idea that groups identify with a sense of taste exclusively has a diminishing utility with the intermingling of popular and high culture in the West (MacCabe 1992: xiii). Still, as I describe below, visualizing through the graph emphasizes an appreciation for abstractness where knowledge expresses uncertainty in temporal order and aesthetic judgment.

## Temporality, Cognition, Emotion

In addition to officiating value through abstractness, the energy graph also indexes a linear temporality. In *The Pulse of Modernism*, Brain (2015) shows how the invention of graphical inscription instruments in the nineteenth century promotes linear temporality by opening new ways for moving from materiality to semiotics (Clarke and Henderson 2002; Daston and Lunbeck 2011). In their attempts to modify the

work of steam engines, engineers, including James Watt, introduced graphical copying processes for mechanically tracing the movement of the piston inside the cylinder of an engine. Brain notes that such instruments, which began crudely by affixing a pencil to a piston rod and then to a registering apparatus made up in part of writing paper, transformed the piston's mechanical movement into a graphical expression.

Previously, productive labor was inspired by a sense of balance and harmony from an idealized understanding of the regularity of natural objects such as the sun, the stars, and the earth (Bakhtin 1994: 209; Elias 1987: 42). The graph shifted the determinant of visual representation away from earlier notions of circularity and toward an obsession with the passage of time:

> The new graphical recording instruments implemented in myriad concrete measures the primacy of linear time in a new cosmos of irreversible forces, conversions, history, activity, progress, energy, and eventually, entropy associated with the [*capitalist*] steam-powered world. In nearly every science—thermodynamics, astronomy, political economy, philology, archaeology, evolutionary biology, and soon, physiology—linear temporality became the critical variable. (Brain 2015: 14–15)

Notably, Brain calls attention to the graph's poetic function by its extension of power from the cognitive realm to the affective. In doing so, the graph amplifies both cognition and emotion through what he calls a *double-reading*: first, the graph involves *intellectual calculation* associated with interpreting the scale of coordinates, time frames, and ruptures that reenact the event inscribed; second, the graph requires *sensual-intuition* associated with the rising or falling line, rhythm of direction, and repetition.

The humanities scholar Heather Houser (2015) points to a double-reading of the graph in her exploration of InfoVis or information visualizations on the internet. InfoVis are skillful presentations of complex data sets that can bring viewers to the point of "infogasm" through an allure of imagery that promises knowledge. The material performativity of the internet's speed of transferring signals and light through "dispersed material infrastructures" (Gabrys 2011: 58) gives an illusion of immateriality that enables visuals to appear free from the chemicals, metal, and plastics of its resource requirements. The popular "flattening the curve," in reference to COVID-19 representations of infected people needing healthcare over time, situates the graph in a globalized mediascape where data transparency aligns with forms of erasure (Ghosn 2012).

The emotions provoked by the graph may be understood as *feeling into* aesthetic production (Lanzoni 2012; Lundbeck 2011). A sculpture, a figure in a painting, a musical composition, may evoke feelings of empathy (Freedberg and Gallese 2007). Colors, shapes, and patterns can also evoke elusive qualities in possession of "vitality affects" (Curtis 2012). These may be described kinetically such as surging, fading away, and crescendo. Susan Gerofsky's (2011) study of Cartesian graphs include positive and negative affects by its division into quadrants.

Recent anthropological discussion of the energy graph emphasizes the popularity of oil projections in transforming feelings of present security into an uncertain futurity (Limbert 2015). Elsewhere (Mason n.d.), I detail a historical shift toward favoring an image of the graph in visual communication. In all manner of conversation—energy supply, $CO_2$ emissions—the graph is a key tool for visualizing the future. I explain the popularity of the graph by reference to key moments: first, its promotion by economists in the restructuring of energy and financial markets during the 1980s (Mason 2007; Zaloom 2009); second, its adoption as science imagery by environmental activists during the 1990s (Wapner 1995). Notably, these events signal a departure from earlier text-based and self-evident visual encounters. As such, viewer engagement shifts from favoring images composed of textual and realistic renderings to images where pleasure occurs from uncertain interpretation. I address this shift as a greater desire for visual abstraction under the title *Empathy for the Graph*.

In the following ethnography, I describe the introduction of an aesthetic regime in Alaska by economic experts who employ the graph to intervene in a deliberative process of energy policy decision-making. I show how the graph officiates relationships to the linear temporal by the way it connects the future of Alaska natural gas resources to global hydrocarbon markets. But I also situate the graph in relation to self-evident imagery taking place at the time. In doing so, I argue that the abstractness of the graph reflects a move toward an aesthetics of refinement and the enforcement of a mode of perception that places restrictions on political deliberation.

## Abstraction through the Graph

Looking back, the winter of 2000/01 was an unbridled kingdom of imaginaries brought on by a period of natural gas market shock. At the eve of a new millennium, the coldest November and December

in a hundred years, in combination with declines in natural gas production and storage, drove North American energy prices to record levels. In Alaska, wish-fulfillment imaginaries accompanied attempts to build a pipeline to monetize the state's vast quantity of natural gas reserves. In no period or location was there such frenzied activity as there was during the twenty-second Alaska state legislature.

In January 2001, during a live televised broadcast presentation to the Senate and House Minority Democratic caucus given by Yukon Pacific Corporation president Jeff Lowenfels on his proposed Alaska Gas Pipeline project, Lowenfels announced, "the discussions centering around a pipeline these days certainly demonstrate we are in a boom-and-bust society. This is like gold fever" (CIG 2001). In a series of high-profile appearances nationwide Alaska governor Tony Knowles sought to build interest in the pipeline project while Alaska energy companies—ExxonMobil, BP, and ConocoPhillips—announced a $100 million study of pipeline construction. Everyone was talking about a "perfect energy storm" brought on by a triple threat of natural gas shortage, oil price shock, and declining use of coal. According to Lowenfels, British Petroleum had ads saying it was "committed to unlocking the potential of Alaska's natural gas," and that Phillips Petroleum announced that commercializing Alaska natural gas was the company's "number one challenge."

Many connected the excitement to lingering memories of the 1970s trans-Alaska oil pipeline boom prosperity. In 2000, oil taxes and royalties supplied 80 percent of the state's general revenue. Alaska oil production peaked in 1988 at two million barrels per day. By 2000 it had fallen by half. While much of the natural gas resource is owned by the energy companies, the State of Alaska holds a significant royalty share (12.5 percent). However, state officials did not have a clear sense of what kind of pipeline could be built. In recent years, North American energy industries had undergone restructuring resulting in new ways for marketing natural gas. The enormous scale of the proposal suggested that state-wide direct employment would be in the tens of thousands with associated jobs in the hundreds of thousands.

To learn about factors affecting pipeline construction governor Knowles retained Cambridge Energy Research Associates (CERA), a global consulting firm with expertise in energy market analysis. Wilson Condon, Commissioner for Department of Revenue, along with other state officials flew to CERA headquarters in Cambridge, Massachusetts, to participate in developing scenario-based studies. Condon was instructed by Knowles to develop a view of long-term investment and what the state could expect in return for selling its resources. Ac-

cording to CERA director, Ed Small, "Condon needed to know what an expert's opinion was on the market fundamentals, he was mandated with that responsibility to ask: 'okay, what does monetizing Alaska gas mean for the state in the context of revenue?'" (pers. conv. 2002). One of the titles of a CERA-based Alaska-client study was *The Alchemist's Challenge: Scenarios for Turning Natural Gas to Gold*.

With Condon's return to Alaska, CERA consultant Ed Kelly flew from Houston to brief the state legislature and the governor on global energy markets. Kelly was CERA director of gas research and director for the Alaska contract. He began his briefing with a review of North American market fundamentals. My initial impression of Kelly was of a man with a patrician's attitude. He displayed no hint of self-deprecation and provided tightly knit sentences from memory. His immaculate features and slightly mechanical manner conveyed total control over the events he described as shaping the energy crisis. Soon afterward, the services of CERA experts became recognized in Alaska as critical for commercializing natural gas. In government documents, political party news releases, newspapers, and speeches, the activities of CERA were deemed "in the State's best interest" and "a critical component of the governor's legislative effort."

Several examples of energy graphs created at the turn of the millennium by CERA appeared together in a sequential packet of images that focused on Arctic natural gas development. I consider these graphs manifestations of a new deregulated stage of energy procurement. The distribution of these graphs reflects an emerging social habitus among those involved in Arctic hydrocarbon extraction. My access to these graphs was structured by my role as a participant observer in the Alaska legislature and later in the Office of the Governor of Alaska in Washington, DC, where I worked on legislative issues related to the Alaska natural gas pipeline. In this role, I became familiar with CERA Member Executive Roundtable Sessions.

Following Peter Adey (2014), CERA roundtables may be considered elite premium networked environments that take place in expensive hotels located in global cities; I have, over time, attended CERA roundtables in Washington DC, Houston, San Francisco, Calgary, and Mexico City. At each roundtable, six or seven CERA experts give individual talks lasting fifteen minutes each. The expert stands near a screen onto which PowerPoint slides are projected. Clients observe and listen, but also follow along in an agenda booklet that they are issued upon arrival. This booklet contains reproductions of the slides that are being shown by the expert. Often clients scribble notes in the booklet, an activity that I came to understand as an effort to elucidate

the relationship between the printed material and its meaning as explained by the expert.

One graph depicted an eight-year span of natural gas prices as understood during the fourth quarter of 2000. The graph was circulated as a PowerPoint image and also as an eight-by-eleven-inch illustration in an agenda booklet. The title of the graph is an open-ended question: *Natural Gas Markets: How Long Will High Prices and Volatility Last?* Together, the graph and title provide an outlook of higher natural gas prices in the North American energy market. Created and distributed in late summer 2000, the graph was discarded in late winter 2001. Thus, at the time of its appearance, the year 2000 was the temporal present and carried the weight of a self-evident fact. The figure 2000 appeared at mid-point in the timeline and was therefore a likely entry point into the graph's symbolism. It carried an attention-grabbing significance as a departure point for exploring the uncertain temporalities that lay beyond it.

Importantly, the graph was an originary visual to a discourse about energy growth imperatives. It is a fragment of evidence in support of "The Long Ascent," a well-regarded expectation at the time of an increase in natural gas consumption, then estimated at twenty-two trillion cubic feet (tcf) and moving to a thirty tcf market by 2010. The graph was also a working-object under the new rules of industry restructuring. As noted briefly, the natural gas industry had shifted to a liberalized market form. Previously, governments provided companies with a structured risk environment that secured rates of profit over fixed periods. These agreements collapsed under liberalization. Thus, price projection in the graph represents a declaration that companies had entered into a competitive arrangement. It announces a shift from the regulatory (textual-juridical) to the economic (graphical-numeric) in determining balances between increases to supply and rises in demand.

In this way, the graph testifies to the disadvantage of destabilizing balance whereby an abundance of supply will destroy price. This would be disastrous for new projects whose investment recovery depends on long-term price stability. By forecasting both the incremental amount of new energy additions that can satisfy demand and by visualizing the price these additions will fetch, the graph serves as an indication of the changing politics of developing new supply sources. While prior to restructuring the political community established incentives for corporate decision-making, by the early 2000s, fluctuation in price, as evidenced in the graph, established the risks by which the industry seeks political concession.

Thus, the CERA graph introduced a new determinant in decision-making. It is a bit of knowledge in a stable stream of information about a system of economics. In this case, it suggests that new instabilities had given rise to a field of experts whose announcements fulfill a collective need for knowledge of pricing, since this knowledge facilitates trade, provides longer-term signals that govern investment, and allows clients to manage risk. The graph is also a collectible object. From my experience, I became a bit neurotic about obtaining CERA graphs suggesting an acquisitive bent that Margaret Wasz (2017: 31) associates with the collector. Wasz points to the feeling of being-in-the world with artwork through embodying some part of its essence through acquisition. In this way, the sensorial graph is an avenue through which thinking takes form and from which an intimacy with abstraction develops.

Skipping ahead within the booklet, a different graph similarly depicts a decadal temporality. Instead of the eleven-year range, this graph depicts a fifteen-year trajectory. Instead of the past, present, and future, it confronts a singular future from an isolated present. It is a visual into the planning stages for pipeline construction to bring Alaska natural gas on-stream. The image portrays dates and events and is a history lesson of the future. The graph appears in the shape of a pipeline, and printed directly below in the booklet is information relating to expectations: capacity size, date of initiation, and timing completion.

Notably, these two graphs were not expected to be viewed independent of one another but appear as part of an installation. Also, both graphs—"Natural Gas Markets" and "Arctic Gas Supply Build"—are similarly placed within the agenda booklet. They appear as the last in a sequence of graphs. They are the concluding images of two separate presentations. As such, they carry the drama of a finale. Their emotive power lies in their appearance as a lasting image and by their capacity to present the sum total of all previous graphs—that is, to have greater meaning than the previous parts to which they owe their lasting appearance. The "Natural Gas Markets" graph appeared as part of a set of initial presentations titled "Market Focus." This graph sums up a story about market dynamics that is captured in a series of thirty graphs that precede it. The earlier images recount the content of "The Long Ascent." In short, the graphs build up information for the final image, but are also inscribed within it. The "Arctic Gas Supply Build" graph appeared in a subsequent presentation titled "Arctic Gas" which, according to the agenda, is the last presentation of the two-day roundtable. Thus, the "Arctic Gas Supply Build" is the final image of all graphs combined.

The terms and shapes of these graphs are worthy of comparison for the vitality affects they generate. In both images, an exteriority of elements symbolizes the penetration of discourse whereby representation and verbal sign are inextricably bound revealing discourse's ambiguous power to redouble (Foucault 2008). One portrays a stratified harmony of points. By contrast, the other presents a singular line rhythmically punctuated like staccato emphases. In the former, rhythmic movement defines a market characterizing creative risk: drivers, ongoing demands, cycles, playing fields, high growths, spikes. The jagged lines guide the eye from left to right toward a finality of parallel lines that present a two-part illusion of progression in which time accelerates toward a finale. By contrast, the latter offers a staid set of terms (commitment, approval, service, process) that frame progress with stability, finality, and the inevitability of commitment to procedure. It is a step-by-step linear visual style.

## Second-Hand Abstraction on Energy Knowledge

Photographic imagery of hydrocarbon development also became popular in Alaska at this time. These images were taken at political events, including legislative hearings and press conferences. They circulated statewide through community newspapers and on internet sites specializing in energy development and appear alongside news stories about construction of the pipeline.

Consider a photograph of CERA director Ed Small and Alaska state commissioner of revenue, Wilson Condon, that appeared with frequency. Viewed on the computer screen, Small and Condon portray an alignment that suggests a shared intimacy of thought. Both men slightly hunch forward and face the photographer at a three-quarter angle. The eyes of both men appear worn as they gaze intently toward a horizon that lies beyond visible reference. The image is cropped just below their shoulders, making visible their suit jackets and white shirts. By decision of the photographer, Condon is slightly blurred leaving Small in focus, and thus, at the center of attention. One caption reads "State consultant Ed Small." Another states, "Ed Small with Revenue Commissioner Wil Condon." The self-evidence of these images resembles classical representation (e.g., Foucault 1970: 16).

When combined with examples of graphical expression above, both sets of images reflect two spheres of Alaska natural gas development—the abstractive industry of consultants and the logic of Alaska politics—by reference to their respective aesthetics. These two types

of imagery invoke two separate aesthetic styles. They are two forms of hydrocarbon development that are linked to the social habitus of different sociohistorical processes.

From the text surrounding the image, Small is assisting Condon, whose goal is to maximize revenue from the sale of natural gas. Thus, the image presents a conceptual space of shared interest between a consultant and state official. It is partial evidence that Small is crucial for delivering Alaska gas into the realm of global markets. What is on display are two sources of energy knowledge that appear bunched together through a solidarity of interest.

I refer to these images as *secondhand observations on energy knowledge*. For the viewer, this image does not reflect a face-to-face encounter but a screen-size portrait that offers proximity based on an absence of firsthand experience. It provides a vantage point for considering the way energy knowledge appears in Alaska and how an idea of an expert takes shape within a wider milieu. For anyone then scrolling through Alaska newspapers, *The Peninsula Clarion*, *Kodiak Daily Mirror*, *Fairbanks News Miner*, *Anchorage Daily News*, the image displays characteristics that differentiate the expert Ed Small from other representations. The body posture, gaze, clothing, the way that a reporter recognizes Small by association with a state official, all provide reference points and sensual modes of display that may be contrasted or compared as rare or mundane with other newsworthy visuals.

Borrowing from Foucault (1980: 97) this secondhand observation is an "external visage" of energy knowledge. Its self-evident aesthetic serves as *the point in representation* where pipeline development is both installed in the imagination of others at a distance and comes into direct and immediate relationship as representation. The fabrication of its visibility demonstrates both a distance to firsthand experience but also the delivery of information through a form of representation in which an *aesthetic commitment* is on display as its own abstracted stand-in for pipeline development. By aesthetic commitment, I refer to the way an image allows a viewer to recognize the body as an inscription device that details the force of social encounters and thus informs on the social habitus of material forces. What is on display in Small-Condon images are material commitments that betray stories of theoretical knowledge, with all its ambivalent gestures, civilian dress, and thoughtful hesitation.

The Small-Condon photograph was taken by David Harbour, a retired oil company lobbyist and by all accounts a recognized veteran of Alaska natural gas development. Harbour created the *North-*

*ern Gas Pipelines* website to document many of the goings on during this period. Harbour, in a series of weblog entries appearing on his website, critiques Alaska state government for allowing "windows of opportunity to escape unopened, into history" (Harbour 2001). Such windows are periods when high-energy prices could enable Alaska pipeline development and, according to Harbour, "are on a train moving through the station, gone in a flash as the invisible hand of supply and demand satisfies the market without us" (ibid). For Harbour, market structure ages rapidly and contrasts with the temporality of political decision-making.

In this way, the Small-Condon image is a critique of Alaska political reason and its amateur stance toward market realities. The speculative gaze of the consultant drawn into focus, its slightly blurred state official, its etiquette of alignment, frequency of circulation, when taken together present an editorial about Alaska's import of expertise: Alaska must embrace an abstractive logic of energy development. For me, what Harbour places on display in the thoughtful gaze of Ed Small are the economic arguments of an expert concerned with the future of energy markets. Harbour's detachment in portraying Small and Condon, as if unaffected by their momentary relationship with the photographer, is a viewpoint on resemblance that indexes indeterminacy. The image agitates Alaska's self-enclosed political self-sufficiency.

## Cyclical Time

In Robert Brain's (2015: 14) work mentioned above, linear temporality in graphical expression displaces earlier notions of "balance." Since temporality plays an important role in my analysis, I want to consider the rituals associated with cyclical time in Alaska politics. The concept of time to which I refer is, of course, the *state election cycle*—for House representatives every two years and for state senators and the governor every four years. It is this politically involved time that is represented in the imagery of self-evident aesthetics and that is disrupted by the detached linear temporality of the graph.

The temporal cycle of Alaska politics was noticeable to me through my daily participation in democratic legislative re-election strategies. Each week, six to seven Senate and House Democratic lawmakers from Anchorage and nearly twice that many in staff, including myself, held a caucus in the office of the Democratic House minority leader. At the time, Republicans held a majority in both the House and Senate. During these meetings, the Senate minority leader reminded

us to develop our "communication plans" so that caucus lawmakers would get noticed back in their home districts. "Getting noticed" was necessary for "building strength as an elected official" and for getting re-elected. Key to such plans were "entrenchment techniques."

The most frequently used entrenchment technique was the mailing packet. The minority leader advocated mid-session mailings, mailings to senior citizens, mailings to community council members, mailings to voters to update their files at the division of elections, as well as end-of-session newsletters to voters. The mailing packet was a four-page brochure to describe activities of lawmakers on behalf of their constituents. Each lawmaker assembled her own mailing packet with the assistance of an aide. The lawmaker that I worked for was also an illustrator who would spend part of her lawmaking time creating drawings and cartoons which she scanned into the mailer to contextualize some of the more complex situations of the Capitol building, such as pending legislation, floor action, floor statements, and committee testimony. Similar activities appeared to be taking place in all offices of lawmakers, leaving me with an impression of the Capitol building as a type of re-election sweatshop. It was a collection of self-contained white-collar offices, each of whose sole purpose was to create attention for getting re-elected. Other entrenchment techniques included the introduction of bills of legislation that would compete against other bills for the attention of media and ultimately to secure re-election.

Returning to my participation in the caucus, the Senate minority leader initiated a "dead elephant" award in recognition of the week's best entrenchment technique. The award was a plastic elephant head roughly the size of a football and mounted on a similarly sized wooden plaque. Each week, a caucus lawmaker would be awarded possession of the head as a symbol of triumph over the Republican majority. On one occasion, the award had gone to a representative for attending the governor's morning press conference on raising the state minimum wage, and for having a staffer send out a press release to labor union workers in the home district. This example draws attention to what the minority leader saw as exemplary in an entrenchment technique: personal appearance in "getting noticed." The representative notifies his constituents of his upcoming appearance; while listening to the governor talk, he stands in a spot that is visible to the governor and to others in attendance including the press; in doing so, he communicates his visibility to constituents. Thus, personal appearance on display (proximity to the powerholder) is what serves as evidence of attentiveness to constituents. An entrenchment technique gets one

"noticed" not only in the home district but among lawmakers in the Capitol.

In my experience, the display of getting noticed accompanied an ambivalence toward comprehension of the concerns being voiced by those gathered with an intended sense of purpose. This became noticeable from my own participation in the televised broadcast presentation by Jeff Lowenfels on the Alaska pipeline, mentioned above. The event was organized by the Democratic party and took place in the main conference room of the Office of the Alaska Governor. Lowenfels sat among Democratic lawmakers in plain view of a gold-painted seal for the State of Alaska.

Looking back at my fieldnotes, I capture a glimpse of this event as a happening that would likely be witnessed differently by the practical obligations of those in attendance. In my case, I remark of staffers taking photographs of their bosses to ensure a ready supply of promotional images for election campaigns. I comment that some participants appear stupefied as if unaware that the voices in their head belong to those sitting at the table talking about hydrocarbon development. In my notes, there is evidence of a personal relationship. I write in detail of Nathan Johnson, a legislative aide to a House Representative. Johnson, who had a bachelor's degree in philosophy, enlisted me in campaigning over the previous nine months. In his role as an election campaign director, he appointed me super-volunteer after my door-to-door campaigning logged in eighty-hour work weeks as part of an attempt to gain access to Alaska energy politics. When my volunteer role diminished, my friendship with Johnson came to an end. Nevertheless, according to my notes taken on that day, I was riveted by Johnson's actions as I watched him "walk around the room taking promotional photographs on the digital camera—his only purpose for showing up. Which really makes sense, as if we can really learn anything about the topic anyway . . . one might as well be in the thick of it and see it for what it really is, a photo op."

Through these manners, a kind of carnival attitude arose that assisted in the destruction of barriers between self-enclosed systems of thought providing a striking combination of what would seem to be incompatible elements in energy transportation infrastructure development: technical and economic dialogue, *the future*, linear temporality, entrenchment technique, personal affections, and tales of adventure. To offer an example of the latter, then Republican US senator Frank Murkowski proclaimed that Alaska may once again become a destination for workers seeking adventure and fortune. He envisioned the pipeline in terms of "a snowball that would initiate an avalanche of

development statewide" (Harbour 2001). In rare agreement with the opposing political party, Democratic governor Knowles addressed the state via television stating: "after decades of false starts and broken dreams, the economic and political stars are finally aligned in our favor" (Harbour 2001).

In this setting, learning about factors affecting pipeline construction may be seen as a type of entrenchment technique for governor Knowles who, as many expected, planned to run for US senator during the next election cycle. Consider a different image of Wilson Condon that circulates during this period. In contrast to the image of alignment discussed earlier, in a second photo Condon appears distracted. He still gazes toward a horizon that lies beyond visible reference. Yet the meaning of his gaze no longer indicates visual attention in the form of a disembodied, beam-like gaze. Instead, Condon is seen *turning away* from the message of his boss, governor Knowles, who appears pictured on the far left. By not attending with his eyes, Condon no longer pays attention with his body, appearing detached and not involved in the politics of development.

The photo, appearing on the cover of the *Juneau Empire*, depicts a contrast between the disinterest of Condon and another man standing beside him whose gaze is focused directly on the words exiting the governor's lips. This man is Pat Pourchot, commissioner of natural resources and his aim is maximizing energy extraction. Governor Knowles instructed these two men to interpret the ideas of Ed Small and other CERA consultants. While both Condon and Pourchot were committed to the institutional identity of the state, their viewpoints rely on their aesthetic commitments—political experience, knowledge of industry, proximity to the governor—which contribute to the shaping of their priorities, forms of obedience, inner attitude, and outward appearance.

For example, economic ideas for Pourchot remain useful to forward the governor's political goals. By contrast, Condon depicts a wider arc for favoring economic expertise. Condon is a Stanford University law graduate who served previously as Alaska attorney general. The historian Stephen Haycox (1998: 129) refers to Condon as possessing an "extraordinary level" of expertise on energy litigation. He organizes departments into efficient, ordered, offices capable of resisting change. Thus, the name Condon circulates with the aura of an expertly trained official. By contrast, Pourchot, with extensive political experience, was widely acknowledged as the governor's personal favorite, providing the name Pourchot with an aura of access to the governor (he has the "governor's ear"). This influence is depicted in the photo-

graph's two-dimensional perspective where the microphones appear directly in front of Pourchot, suggesting that when the governor talks it is Pourchot who speaks.

## Conclusion

Energy graphs depict ideas of time that that are governed by demand and supply interactions as expressed through commodity transactions, the organic growth of market developments, and windows of opportunity. Through the graph, events can be foreseen, studied, and experienced, with the aim of controlling fate. The energy graph provides a sequence of shifts (items that follow upon one another) whose units can assume varied forms that are utterly different from another—shifts from coal to oil to nuclear—but also within a broader outline of energy capture as a belief in mankind's endless progress. Such graphs create an intimate relation to the world by disassociating the viewer from its objects of representation. By dramatizing representational distance from the substance of things, the graph marks a shift in perception from a desire for immediate recognition to an appreciation for open interpretation and abstraction.

In this way the energy graph is an empiricist construction whose subjective reality of the certainties, techniques, and material environments make up an adequate phenomena of an economic objective reality. Following Karin Knorr Cetina's (1993) metaphor of knowledge construction as a form of empiricism, the energy graph is an object made to facilitate empirical success, where *representation is a model of adequate phenomena* whose conceptual entities are seen in direct relationship to objective realities of investment decisions. Consider the way high prices for oil do not lead to the creation of energy graphs for hydrocarbon development in Congressional protected areas, such as the Alaska National Wildlife Refuge that is estimated to hold several billion barrels of oil.

However, the energy graph also offers expectations that belong to a progressive techno-economic realm which, like that of artwork, is seen as an independent signifier beyond the interests of its authors. Indeed, according to the accounts of CERA analysts themselves, the graph represents an "independent stance from any particular sector of the energy industry" (Kelly 2003). Institutions, epistemologies, and knowledge claims are products accepted to be heavily influenced by social forces while their analysis has erased the positivist picture of energy policy development as a purely rational activity (Hajer 1993).

Still, as the process of regulatory decision-making edges beyond restructuring, its outcomes are increasingly the result of participants' interactive and interpretive work under the sign of a new abstractive aesthetics.

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## Notes

1. According to the philosopher of aesthetics, Hans-Georg Gadamer (1975: 168 fn. 59), representation in early Christian incarnation is synonymous with replacement (see also Auerbach 1957: 64–5)—an imperialist gesture that art historian Svetlana Alpers (1983) calls "interpretation without representation."
2. I insert "political" in place of Marx's "ancient conception" in which man appears, following the observation of Jürgen Habermas (1989: 13) that the "nobleman was what he represented; the bourgeois, what he produced."
3. Through an image of the graph, the real and effective value in processes of energy production finds its equivalence in processes of energy consumption, in which its use-value is expressed.
4. Peter Sloterdijk (1982) employs a similar regime which he labels cynical reason and joyful kynicism. Both the Kantian aesthetic and cynical reason tend toward a rejection of the obvious in favor of abstractness. This aesthetic suggests a sense of taste that favors hesitation or reflection and is acquired through professional achievement. By contrast, both the anti-Kantian and joyful kynicism celebrate the structure of the *already there.* This regime of aesthetics is taste that favors the sensual and immediate.

## References

Adey, Peter. 2014. "Security Atmospheres or the Crystallisation of Worlds." *Environment and Planning D: Society and Space* 32: 834–51.

Almklov, Petter, and Vidar Hepsø. 2011. "Between and Beyond Data." *Social Studies of Science* 41(4): 539–61.

Alpers, Svetlana. 1983. "Interpretation without Representation or the Viewing of *Las Meninas.*" *Representations* 1(1): 30–42.

Auerbach, Erich. 1957. *Mimesis: The Representation of Reality in Western Literature*. New York: Doubleday.

Bakhtin, Mikhail. 1994. *The Dialogical Imagination*. Edited by M. Holquist. Austin: University of Texas Press.

Barry, Andrew. 2013. *Material Politics*. London: Wiley.

Benjamin, Walter. 1969. "The Work of Art in the Age of Mechanical Reproduction." In *Illuminations*, edited by Hannah Arendt, translated by Harry Zohn. New York: Schocken Books.
Bourdieu, Pierre. 1984. *Distinction*. London: Routledge.
Brain, Robert. 2015. *The Pulse of the Modern*. Seattle: University of Washington Press.
Budd, Malcolm 2008. *Aesthetic Essays*. Oxford: Oxford University Press.
CIG 2001. Capitol Information Group. Cambridge re- ports on gas market. *Alaska Gas Line Review, Legislative Report*, 7 March. Juneau, Alaska.
Clarke, Bruce, and Linda Henderson, eds. 2002. *From Energy to Information*. Stanford: Stanford University Press.
Curtis, Robin. 2012. "Einfühlung and Abstraction in the Moving Image: Historical and Contemporary Reflections." *Science in Context* 25(3): 425–46.
Daston, Lorraine, and Elizabeth Lunbeck, eds. 2011. *Histories of Scientific Observation*. Chicago: University of Chicago Press.
De Saussure, Ferdinand. 1983. Course in General Linguistics. London: Bloomsbury Revelations.
Elias, Norbert. 1987. *Involvement and Detachment.* Oxford, UK: Blackwell.
Farrell, Alex, and Adam Brandt. 2006. "Risks of the Oil Transition." *Environmental Research Letters* 1: 014004.
Freedberg, David, and Vittorio Gallese. 2007. "Motion, Emotion and Empathy in eEthetic Experience." *TRENDS in Cognitive Sciences* 11(5): 197–203.
Foucault, Michel. 1970. *The Order of Things.* New York: Vintage.
———. 1977. *Discipline and Punish: The Birth of the Prison*. New York: Pantheon.
———. 1980. *The Archeology of Knowledge*. London: Routledge.
———. 2008. *This is not a Pipe*. Berkeley: University of California Press.
Gabrys, Jennifer. 2011. *Digital Rubbish*. Ann Arbor: University of Michigan Press.
Gadamer, H. G. 1975. *Truth and Method*. London: Continuum Publishing.
Gerofsky, Susan. 2011. "Ancestral Genres of Mathematical Graphs." *For the Learning of Mathematics* 31(1): 14–19.
Ghosn, Rania. 2012. "Where are the Missing Spaces? The Geography of Some Uncommon Interests." In *Persecta #45: Agency.* Cambridge: MIT 109–16. Press.
Habermas, Jürgen. 1989. *The Structural Transformation of the Public Sphere*. Cambridge, MA: MIT Press.
Harbour, David. 2001. Arctic Gas Pipeline website. Retrieved 28 January 2019. http://www.arcticgaspipeline.com/Op-Ed%20Author%202001.htm
Hajer, Maarten. 1993. "Discourse Coalitions and the Institutionalization of Practice." In *The Argumentative Turn in Policy Analysis and Planning*, edited by Frank Fischer and John Forester, 43–76. Durham, NC: Duke University Press.
Haycox, Stephen. 1998. *The Law of the Land: A History of the Office of the Attorney General and the Department of Law in Alaska*. Juneau: Alaska Department of Law.
Houser, Heather. 2015. "The Aesthetics of Environmental Visualizations: More than Information Ecstasy?" *Public Culture* 26(2): 319–37.
Kelly, Edward. 2003. Statement on Behalf of Wood Mackenzie Global Consultants, US House Subcommittee on Energy and Mineral Resources, Washington, DC, 19 June.

Knorr Cetina, Karin. 1993. "Strong Constructivism—from a Sociologist's Point of View: A Personal Addendum to Sismondo's Paper." *Social Studies of Science* 23(3): 555–63.

Lanzoni, Susan. 2012. "Empathy in Translation." *Science in Context* 25(3): 301–27.

Levander, Caroline, and Matthew Guterl. 2015. *Hotel Life.* Chapel Hill: University of North Carolina Press.

Limbert, Mandana. 2015. "Reserves, Secrecy, and the Science of Prognostication in Southern Arabia." In *Subterranean Estate*s, edited by H. Appel, A. Mason, and M. Watts, 330–43. Ithaca: Cornell University Press.

Lunbeck, Elizabeth. 2011. "Empathy as a Psychoanalytic Mode of Observation." In *Histories of Scientific Observation*, edited by Lorraine Daston and Elizabeth Lunbeck, 255–75. Chicago: University of Chicago Press.

MacCabe, Colin. 1992. "Preface." In *The Geopolitical Aesthetic: Cinema and Space in the World System*, edited by Fredric Jameson, ix–xvi. Bloomington: Indiana University Press.

Marx, Karl. 1964. "Pre-Capitalist Economic Formations in Works of Karl Marx 1857–58." Translated by J. Cohen. Retrieved 15 May 2021 from https://www.marxistsm.org/archive/marx/works/1857/precapitalist/ch01.htm.

Mason, Arthur. 2007. "The Rise of Consultant Forecasting in Liberalized Natural Gas Markets." *Public Culture* 19(2): 367–79.

———. n.d. "Empathy for the Graph" In *Energy Image: Hydrocarbon Aesthetics of Progress and Form*. Unpublished manuscript.

Monteiro, Eric, Gasparas Jarulaitis, and Vidar Hepsø. 2012. "The Family Resemblance of Technologically Mediated Work Practices." *Information and Organization* 22: 169–87.

Ricoeur, Paul. 1975. *The Rule of Metaphor*. London: Routledge.

Rosato, Donna. 2002. "Worried about Corporate Numbers? How about the Charts?" *New York Times,* 15 September, Business Section.

Sloterdijk, Peter. 1982. *Critique of Cynical Reason.* Minneapolis: University of Minnesota Press.

Tsing, Anna. 2012. "On Nonscalability: The Living World is Not Amenable to Precision-Nested Scales." *Common Knowledge* Volume 18(3): 505–24.

Wapner, Paul. 1995. "Politics Beyond the State." *World Politics* 47(3): 311–40.

Wasz, Margaret. 2017. "Why Do We Collect." In *On Collecting*, edited by André Gali, 29–40. Oslo: Norwegian Crafts.

Wittgenstein, Ludgwig. 1956. *Philosophical Investigations*. London: Macmillian Press.

Zaloom, Caitlin. 2009. "How to Read the Future: The Yield Curve, Affect, and Financial Prediction." *Public Culture* 21(2): 246–68.

AFTERWORD

# Arctic Abstractions

Michael J. Watts

There are a number of words, what Raymond Williams (1985) calls keywords, which seem be central to the current political moment, and to what one might describe as contemporary liberal governance. Security, risk, resilience, community, and individualism—all markers of liberal governmentality—would be among them, perhaps even moreso during COVID-times. Dependency would likely be another, a keyword that is arguably the single most important term in contemporary discourse on welfare, entitlements, and personal responsibility. To be dependent—upon the state, upon food kitchens, upon popular charity—is a marker of a certain sort of individual failure, pathology even. Dependency carries a stigma and a stain: the implication is a failure to thrive and to achieve independence and self-sufficiency, and in ideological terms to exhibit a number of pathologies or failings (laziness, a lack of thrift, a failure to self-manage, plan, invest, and limit particularly destructive drives).

Raymond Williams's glossary of complex keywords emphasized shifts in historical semantics, new meanings that are intimately bound to the social and political changes of preceding centuries. Keywords were significant and *binding* in their deployment and interpretation, and significant and *indicative* in "certain forms of thought" (1985: 15). Each keyword occupies a complex semantic space—historically situated registers of meaning—in which, as Williams put it, the problems of the words' meanings were "inextricably bound up with the problems it was being used to discuss (p. 15)." Williams's *Key Words* was less concerned with mechanisms governing meaningful change than

in the pressures under which people—classes, social groups—extend and transform word meanings. While the meanings of keywords were unstable, changing over time, Williams chose to accentuate the adversarial uses of language rooted in society as an arena of conflictual interactions and struggles between different social forces. All of this highlighted the social contradictions inherent in meaning attribution: keywords are contested, fought over, and subject to moral and ethical standards and assessment, all the while exhibiting complex, interlocking contemporary meanings whose interaction inevitably remains unresolved.

Neither abstract nor abstraction appeared in Williams's breviary. But both words have good reason to be there.[1] A book devoted to the abstraction—and the extraction-couplet—must of course confront the conundrum of William's multiple registers of meaning. There is a general etymological sense in which abstraction implies a removal, a paring away.

> Abstraction begins with action, with lines drawn and a cleavage made. It is commonly used as a quantity that can be possessed . . . yet fundamentally the term necessitates a move, and one with direction. The OED includes several variations on "abstraction," but all of them involve "withdrawing," "separation," or "removal." . . . This sense of striping away the context applies to all instances of abstraction. We should then ask—what is being removed? (Park 2003, para. 1)

> Individuals are now ruled by abstractions, whereas earlier they depended on one another. (Marx 1973)

> Everything comes down to Aesthetics and Political Economy. (Mallarmé 2012)

> A photograph is a secret about a secret. (Arbus 2016)

According to the Oxford English Dictionary (OED) the word's Latinate derivation relating to separation (*abstrāctiō)* and draw away (*abstrahō*) is reflected in modern usage where it may euphemistically invoke secret or dishonest removal, pilfering, purloining, all properties that appear in some form in the vivid accounts of Arctic abstraction that appear in this book. The OED offers the following definition: "the act or process of separating in thought, of considering a thing independently of its associations; or a substance independently of its attributes; or an attribute or quality independently of the substance to which it belongs." In keeping with the sense of separation and rift, Max Weber famously defined abstraction in regard to "isolation" and

"generalization" to which in, his updating of the term in sociological theory, Swedberg (2020) adds a third property, namely the notion of "levels" (the parallel here is with the notion of logical typing). But the general point holds: abstraction implies some sort of direction, movement and separation. Stephen Park (2003) properly observes abstraction is hard to pin down universally but rather must be thought of in terms of what it is working against or separated from: "It will not do to simply locate abstraction, to speak of abstraction *in* something, rather we must also consider its origin, in other words, abstraction *from* something." The word, in short, is binary, or more properly dialectical, containing within it etymological circumference of a broad sense of purification. Naturally, the referent—what is being moved or withdrawn or separated *from*—accounts for the specific meanings, the differing registers.

Abstraction takes shape—that is to say, is lifted or withdrawn from and examined in reified form—in relation to that which it opposes or to which it serves as a counterpoint. In this book the counterpoint is extraction—or what I will call the concrete (Mason in his introduction notes that the "slippage" between the two terms "registers various kinds of movements from the material to the immaterial or symbolic and back again"). Abstraction in both common and scientific parlance assumes a number of shapes. In her insightful account of abstraction and finance and money—arguably a phenomenon, along with space, that has generated some of richest accounts of abstraction and social life as Mason shows in his introduction (see Harvey 2006; also Stanek 2008; Adkins 2020)—La Berge (2014a: 94; 2021, 2016) properly notes that the word has so many varied meanings, so many theoretical traditions that its "precise meaning . . . [is] almost impossible to ascertain." In art, and aesthetics more generally, the abstract (Rothko's color fields) stands in opposition to the figurative; in philosophy it refers to something existing outside of space and time; across the social sciences abstraction is something that exceeds the specific and particular; in the biophysical sciences abstraction is central to method and to hypothetical-deductive model building. Within Marxisms of various stripe—Marxian political economy arguably has the most robust theoretical lineage within the social sciences on the relations between the abstract and the concrete—there are a raft of forms of abstraction: real abstraction, lived abstraction, second order abstraction, and so on.

The aims of abstraction differ too as La Berge shows: in art, abstraction provides "medium specificity," while in social theory—for example, the idea that the economy is performative or a twentieth

century historical abstraction (invention)—abstraction is metonymic, in which an incomplete representation stands in for something more capacious "that cannot be represented" (in this book Howe's invocation of the iconic image of the polar bear—the canary in the mine so to speak—and the Arctic crisis is a case in point). The diverse register of meanings in which abstract (as a descriptor) and abstraction (as a process) is well represented across the volume as they are put to work in understanding "Arctic late industrialism" (and the circumpolar world more generally). The chapters reflect upon the function of metrics and indicators and their work in decontextualizing and depoliticizing as they quantify, rank, and measure, foundational aesthetic forms (the graph, the photograph) that work to "persuade, seduce, and conjure" (Mason's language) and the abstractive forms of expertise employed in the service of valuing and monetizing (each some of the most complex forms of abstraction). The very title of the book that invokes abstraction as an *industry* is telling. Abstraction, representation, and agency (Toscano and Kinkle 2015; Toscano 2008)—the ways in which separation, envisioning, and practice emerge in the context of the "New Arctic"—appear in a multiplicity of configurations in *Arctic Abstractive Industry*—melting ice, oceanic sensing, forms of visualization, gas frontiers, and Indigenous signification. At stake are both the accomplishments of abstraction and its tragic failures and excesses.

In his introduction Mason offers a very useful starting point for thinking about abstraction and the cryosphere, a dialectical world of both unbecoming (decay, ruin, endangerment) and becoming (the "New Arctic," see Serreze 2018), a new world of speculative and the spectacular, Anthropocenic accumulation. Abstraction, Mason suggests, refers to the "value of the substance of a thing (whether living or nonliving) by reference to the conditions of its becoming and to further inversions of value that lead toward its becoming something else." It is a definition consistent with the notion of removal and purification that I invoked earlier but also breaking from it. To abstract is to detach a part of reality and put into relation with, and often opposition, to the whole, "leading to an inversion in its ascribed value." Abstraction is at once, he says, a creative act of recognition and a construction of a new reality in which *value* (itself constituted through complex forms of abstraction) is in play. From this perch he poses a raft of questions: What are the politics of representation in this contested terrain? Whose stories are being pressed into service, and to what ends? While Mason does not make clear how abstraction and representation are related as conceptual matters, in my brief remarks

I wish to offer a few observations on this framing and what it might offer our understanding of an emergent Arctic, speculative spaces, digital oceans, and economic forms, more specifically financialized (and neoliberalized) forms of contemporary capitalism.

One of the conceits of *Arctic Abstractive Industry* is that it seeks to focus on variously articulated sites of industrial extraction and ecological vulnerability in the contemporary Arctic while "departing" from ( though necessarily "invoking") extraction and extractive space (what Gavin Bridge (2009) metaphorically describes as the "hole in the ground" approach). In this sense one might say that the extractive stands in for the concrete (rather than the abstract). This of course poses the question of what makes the concrete concrete and the abstract abstract? Marx is, I think exceptionally useful here. Within Marxism, abstraction serves as an indispensable vehicle and yet a hindrance to political economy. Marx deploys the term abstract quite regularly across his work: "Individuals are now ruled by abstractions," he says in the *Grundrisse*, where the *now* (capitalism) is constituted by abstract labor power as the condition of possibility of capital (1975). As La Berge (2014) brilliantly notes, the concrete is a metabolized result and the abstract a social intuition capable of leading to the concrete. The concept is concrete, says Marx, because it is "a synthesis of many definitions, thus representing the unity of diverse aspects," whereas "the most general abstractions arise only in the midst of the richest possible concrete development, where one thing appears as common to many, to all" (in La Berge 2014: 97). In sum, the abstract and the concrete are not exclusive but dialectically constituted, each is realized through the other: real abstractions. The dialectical relation between of the concrete and the abstract—the extractive-abstractive couplet—must be maintained if the dangerous reefs of idealism on the one hand and crude empiricism on the other are to be avoided. All of this points to a larger point. If extraction is the concrete, in the Marxian frame, it too contains, or better still, cannot be construed exclusively as a concrete phenomenon. Richard Swedberg's (2020) recent account of the abstract makes this very clear when he offers a "formal definition" of abstraction as follows: "an abstraction is a representation of a phenomenon that is the result of a selection from another representation, which refers to a more concrete reality."

Marxism points to three articulations of abstraction relevant to the contributions on Arctic late industrialism (see Butler 2016). First, in capitalist society the abstract functions concretely. As Paci (1969: 11, 18) puts it: "this concrete function, notwithstanding the fact that it is really abstract, is bound to precise consequences: the social relation

appears as if it were a thing and in fact functions as a thing, while it is not a thing. . . . *The fundamental character of capitalism . . . reveals itself in the tendency to make abstract categories live as if they were concrete*" (emphasis added). Second, Marx (1975) presents abstraction as driving both processes of intellectual fragmentation and the alienation of people from their labor and their lived, bodily experiences. The link between abstraction and alienation is central to the work of Moishe Postone's reconstruction of Marx's social theory focusing on the central role played by the domination of people by "abstract, quasi-independent structures of social relations" (1993: 125). Capitalist social relations secure domination via abstraction and impersonality. In Marx's (1973: 164) words, "Individuals . . . are now ruled by abstractions, whereas earlier they depended on one another. The abstraction, or idea, however, is nothing more than the theoretical expression of those material relations which are their lord and master. And third, in capitalism it is labor that is both concrete and abstract, and that tension is replicated and externalized in other forms" (including as Mason notes in other forms of value, such as money) *and* in forms of social organization and knowledge. Regardless of the primacy of one real abstraction (money) over another (labor power), says Robert Gehl (2012), "the effects of any real abstraction include material consequences . . . real abstractions express themselves in social organization and are expressions of social organization." The reality is human agency, the abstraction is the immaterial constitution of a whole way of life. A central purpose of *Arctic Abstractive Industries* is to explore these relations between abstraction and forms of life and abstraction is a red thread running across this book.

One domain in which real or concrete abstractions have been deployed to great effect is the production of social space under capitalism—a space for example like the Arctic. Henri Lefebvre (2005) in his theorization of the multi-scalar and hyper complexity of space under capitalism, drew upon Marx directly and the idea that abstraction becomes real in practice (Stanek 2008; Butler 2016). Lefebvre (2009: 88) noted that "there can be no pure abstraction"—no pure abstract space—but rather the "concrete abstract." He offers an account of the rise of forms of abstraction in thought, practice, and experience in association with the different transformations of modes of production of social space under global capitalism. Abstract forms can be understood in part through the ways in which special processes—fragmentation, scale, nesting, networks—are part of the real abstraction of existing forms of capitalism. These sorts of ideas have been usefully employed in the extractive arena, for example, the concept

of "hyper-extraction" or "the planetary mine" what has been termed expanded, extended, or enhanced extraction (McNeish and Shapiro 2021). These ideas draw upon three strands of political economy. One is the move to deterritorialize and render planetary the mine, and the idea that "capitalist urbanization secrets the planetary mine—everyday, above ground, scattered, diffuse, perpetual and swelling" (Labban 2014; also Arias-Loyola 2020). Central to the planetary approach is not simply scale, and interconnectivity (the city as the "inverted mine") and breaking with methodological nationalism (the extractive nation or state); rather it is to see extraction as a set of shifting dynamic frontiers produced and enmeshed in forms of contemporary racialized capitalism and empire. A second is the related work of Sandra Mezzadra and Brett Neilson (2020) in their book *The Politics of Operations*.[2] Their focus is on the production of multiple edges and frontiers of expanding capitalism, the layered sovereignties and variegated legal spaces of global capital,[3] and the new spatial and temporal complexities of capitalism associated with capital's circulation and colonization of social life, what they call the politics of operations. In particular it is the operations of a trifecta of sectors and their connections that provide the core entry point: extraction, logistics, and finance.[4] Here we are necessarily tacking back and forth between the concrete and the abstract, between materials, flows, sensing, asset classes, money, the image world, and multiple forms of expertise.

The third I shall refer to as extractive rents and value grabbing (a deep resonance here with Mason's introduction), a body of work that has collectively addressed the question of contemporary capitalism and rule by rentiers (Mazzucato 2018; Piketty 2014; Standing 2016). At the heart of this work too is an engagement with the extraction-abstraction interface. Not surprisingly, financial rentiers, which is to say firms engaged primarily in financial activities and earning revenue primarily through the ownership and exploitation of financial assets, have been in the spotlight, the principal agents of what has come to be seen as the dominance of Wall Street and finance capital. As a form of critique, rents are seen as "unearned" (rather than productive as a source of accumulation) and owners of land, mineral resources, intellectual property, and a panoply of other income-generating financial and non-financial assets are seen to exercise a sort of hegemony within a neoliberalized and financialized capitalism. When economists refer to a rent seeking political economy, they typically invoke a lack of market competition and hence the source of rent is state intervention or restrictions on economic activity. Others see rent as any income derived from ownership, possession, or con-

trol of assets (including financial assets) that are scarce or artificially rendered scarce. Implicit in differing explications of rent—too complex to enter into here—is the notion of a monopoly of power not only of ownership or control but in the marketplace. In this sense rents are income derived from the ownership, possession, or control of scarce assets under conditions of limited or no competition (Christophers 2019, 2020).

Central to the rentier world so defined is the determination and distribution of property rights that are not deployed to produce new commodities but rather to extract value via rent (what has been called "value grabbing" through "pseudo-commodities" see Andreucci et al. 2017). There is, to take the idea of a planetary extractive system, an expanding class of rentiers operating in the interstices of, for example, the multiple agents in the oil and gas assemblage (financiers, commodity traders, oil insurgents, politicians, military, corporations, and so on) who as it were profit without producing (Lapavitsas 2009). Rent-bearing assets—how they are created, their opportunities to extract value, and conflicts and struggles over the property rights that underlie them—are pivotal to contemporary capitalism, and to extraction in particular. Certainly, the state figures centrally in rents because: (i) it typically creates and institutes property rights; (ii) regulates, enforces, and legitimates the distribution of rights and titles and their use; and (ii) because (and this is especially so in oil state), it is itself or acts like a landlord (a "land appropriating state" or "landlording state"[5]). But these rights might also inhere in international law or through multilateral institutions. Either way, as Andreucci et al. (2017: 38) put it, "the proliferation of private property relations over everything imaginable significantly expands the terrain for rent extraction and related struggles."[6] All of this moves extraction into multiple registers and multiple forms of abstraction.

But planetary extraction and the dominant forms of neoliberalized finance capital associated with it, point to the importance of the massive proliferation of rents and rent opportunities—"value grabbing"—to the operations of the oil and gas assemblage. This is no longer solely a product of corrupt rent-seeking petro-states but operates across multiple spaces and sectors, across the licit and illicit, and among cores and frontiers, a development which has the effect of highlighting the blurring of conventional boundaries and borders in thinking about the global political economy of extraction. This is very much one aspect of Bennett's notion of the "double frontier" in this volume.

I want to conclude with two other brief illustrations that speak to the extraction-abstraction interface and that highlight a number of threads running across the chapters—questions of sensing, iconographic images, and forms of representation—and, to quote from Mason's introduction, how abstractions mediate ecological, political, technological, economic, and cultural inversions of value brought about by energy extraction in the Arctic and the transformation of vulnerability into forms of value. The forms of spatial abstraction—cartography and GIS for example—is especially relevant in the Arctic as the work on the ice edge has shown (see Steinberg and Kristoffersen 2017). The map is of course not the territory and questions of the conditions of production, circulation, and legitimation of such maps—of Arctic edge, or the sea floor—require precisely the sort of engagement with real abstractions that this volume raises.[7] Mason's chapter on the graph is especially generative here and is an echo of other work some of the chapters address, namely sensing. Mason's examination of the graph—political aesthetics, and to invoke Mallarmé (2012) at the head of this chapter, the relations between aesthetics and political economy—can be productively situated on a larger canvas of what Buck-Morss (1995) and others have called "envisioning the economy," that is to say how the abstractions of capitalism (capital, the market, divisions of labor) are displayed. The history of visualization is key (Friendly and Wainer 2021; Halpern 2015). Buck-Morss (1995) shows using classical political economy how the economy—fixing and making it—is a representational problem (e.g., Toscano and Kinkel 2015), a sort of cognitive mapping of the sort Mason describes in the Alaska oil and gas sector. There is a powerful echo in the ways that Mason depicts graphs put to work and the much earlier inventions of graphs and pie charts—the seventeenth-century Dutch cartographer working for the Spanish court, Scottish engineer William Playfair working for the Royal Navy—who saw clearly that a story, a narrative, a history could all be "physically seen on a page by abstracting it along a thin inked line" (Fry 2021).

To conclude I want to focus on two abstractive issues: the "digital Arctic,"[8] and the abstractive processes of commodity trade. On the digital Arctic, let me begin with Kalvin Henely (2012): "If you think of Wall Street as capitalism's symbolic headquarters, the sea is capitalism's trading floor writ large." Deepwater resource exploitation of various sorts—oil extraction at eight thousand feet in the Gulf of Mexico, or deep-sea mining of polymetallic nodules offshore in Papua New Guinea—and the world of oceanic extraction—a sort of model

of "high tech" logistics and circulation if ever there was one—offers up many of the insights into the hyper-extraction world of logistics, finance, and the operations of contemporary capital and geopolitics.

Two vignettes. On 2 August 2007, a Russian submarine with two parliamentarians on board planted a titanium flag two miles down under the North Pole. At stake were the lucrative new oil and gas fields—by some estimations ten billion tons of oil equivalent—on the Arctic sea floor. A decade later in December 2017, the US National Oceanic and Atmospheric Administration (NOAA)—a significant arm of the US Department of Commerce—released a report proclaiming a "New Arctic," signaling massive, irreversible phase changes in the material composition of the Arctic Ocean and its peripheries.[9] A world of forbidding sea ice is now construed through the lens of runaway melt, thaw, liquefaction, and off-gassing. A *new ocean* is in the making, demanding to be observed, represented and documented, exploited, and policed at multiple scales.[10]

Confronting new systems of global oceanic and atmospheric circulation, a vast constellation of satellites, drones, buoys, cables, supercomputers, servers, and sensors will give form to the New Arctic, a digital ocean whose geo-economic and geostrategic value inheres in its rendering as a calculative, computational domain (Steinberg and Kristoffersen 2017). A liquid Arctic is both a knowledge and infrastructural frontier—calling on new forms of "environmental intelligence" (EI) and logistical orders of extraction, circulation, and securitization to come into being. But it is also a new frontier of accumulation, a so-called trillion-dollar ocean. What is at stake is building a logistics space for the Anthropocene.

One part of this digital Arctic story is expressly about oil and gas. Deepwater oil and gas production in the Arctic (and elsewhere) is, of course nothing new; the logistical and infrastructural investments in the oil and gas global supply chain has already left its profound footprint not simply on the ocean floor but in and through the oceanic world (pipelines, flow-stations, risers, rigs, tankers, tank-farms, gas flaring vents, semi-submersible rigs, blowout preventers, and so on).[11] It is now commonplace for test wells to delve through seven thousand feet of water and thirty thousand feet of sea floor to tap oil in tertiary rock laid down sixty million years ago. One test well might cost over $250 million. A great deepwater land grab is in train: primitive accumulation at seven thousand meters. Warming wrought by global climate change has opened Arctic prospects containing an estimated eighth of the world's remaining oil, and a quarter of its gas (according to the US Geological Survey). Geographer Leigh Johnson

(2010) calls this positive feedback loop capital "accumulation by degradation." The arrival of peak oil has triggered increasingly high-risk techniques and geographies of extraction, especially in deep water and the extreme environments of the Arctic's oceanic milieux. The research involved in this turn has resulted in ever more sophisticated sensing, mapping, modeling, and simulation of each phase of oil production.

NOAA has adopted environmental intelligence—rebranding itself as "America's environmental intelligence agency" to explicitly mold the New Arctic policy narrative as a security concern through the problem of data production, management, and deployment. Adapted from long-standing military-scientific techniques of geographic, meteorological, and otherwise geophysical knowledge production, EI enframes the New Arctic through an established military-industrial-academic complex operating at many levels: structural, logistical, infrastructural (see Arroyo 2021). The scope of ocean monitoring is widening, and an infrastructure is being built to span the oceans. Getting things—information, commodities, people—in circulation entails a sort of mapping of the margins, the new oceanic frontiers, and given the deep history of oceanic life, projects of capitalization, extraction, militarization, territorialization, and policing. DARPA (the US Defense Advanced Research Projects Agency) has a unit—the Ocean of Things, a play on the Internet of Things—that aims to deploy fifty thousand sensors across one million square miles of sea.

What distinguishes the contemporary variant of EI, however, is the addition of speculative finance capital and its logics of risk to the equation, mobilizing this complex in new directions. By giving shape to the risk landscape, EI becomes a strategic domain of value in itself that maps out possible scenarios and multiplies speculative opportunity through the trafficking of New Arctic futures. EI asserts the broader ascendancy of geospatial data in the valuation and evaluation of risky, uncertain futures as a space of economic and political securitization—it is a sort of emerging market—and makes use of the vast resources of Silicon Valley rather than secret state technologies and military satellites, ships, and other sensing platforms typical of Cold War–era big science. Bay Area firms focus on small, automated, cheap systems—from Saildrone's unmanned solar and sail-equipped sensor packages to Planet Labs' cubesat swarms—to produce data market ready for just-in-time maritime logistics, everywhere-war security operations, and of course for the extractive sector.

The very idea of a new Arctic Ocean maps out an abstract space: yet-to-be observed, represented, exploited, and policed at multiple spatial

and temporal scales (this is part of the stakeholder narrative in regard to sensing provided by Hepsø and Parmiggiani). EI arbitrates and mediates in other words the New Arctic's figuration and governance as a field of risk and opportunity. In delimiting the New Arctic as an epistemic object and expanding the means by which the region's strategic worth might be evaluated, NOAA's coinage of the New Arctic might appear to be a predominantly American project of a techno-political sort, but it is a supranational enterprise as important to Norway and Russia as it is to China or Canada. New investments abound: the Shell Ocean Discovery XPRIZE to "Accelerate Technology Breakthroughs for Rapid and Unmanned Ocean Exploration"; DARPA's POSYDON communications and navigational system for the deep ocean; China's new fleet of nuclear-powered icebreakers; Equinor's competition to develop artificial intelligence and machine learning technologies for iceberg detection (the chapter by Vidar Hepsø and Elena Parmiggiani explores these trends in relation to computational sensing technologies and simulated models, both of which are capable of translating the complexity of the environment into measurable indicators). This infrastructural boom has helped construct a vast and growing constellation of satellites, drones, buoys, cables, supercomputers, servers, and sensors, a commercially oriented cognitive apparatus for charting the New Arctic resource frontier.

The Ocean of Things is of course in the process of both speculation and value. It requires finance (Silicon Valley is already on board) and opens up opportunities for finance capital. And then there is finance capital and state-led investment, the real of abstraction par excellence. Contemporary with the NOAA report, Guggenheim Investment Partners LLC, a New York firm, offered the first Arctic-specific investment portfolio while China published its first comprehensive Arctic strategy for a Polar Silk Road. The US defense contractor and ocean technology startup Liquid Robotics, a Boeing subsidiary, outlined its vision for a digital ocean. The Arctic mineral and energy frontier is what Alexander Arroyo (2021) calls a geography of speculation, building a digital ocean as "a homogenous quantified space . . . to maintain active control over the conditions of circulation."

More generally, new technologies offer the possibility of enhanced recovery rates, the opening of new frontiers previously foreclosed (fracking is an obvious case), and the deployment of high-tech instruments for discovery, estimation, and surveillance of resources (three-D seismic for example in deep water mining). The very idea of the digital mine[12] or the digital transformation of the oil industry (virtual reality, intelligent automation, and interconnectedness of all

devices, hardware will change the face of day-to-day oil and gas operations[14]) are cases in point. Oceanic oil and the digital Arctic reveal how the concept of hyperextraction offers a sort of full-screen technicolor picture of twenty-first-century extractive-abstractive political economy—speculative and spectacular forms of accumulation in which the abstractive industries are put to work. It points to a planetary oil and gas assemblage, for example, in which the politics of operations on the ground encompass extraction, logistics, technology, and finance.

Finally, the world of making commodities moves and circulates in its relation to abstractive industry. Until recently, the trading system (the circulation of commodities associated with extraction), has not been a major arena of scrutiny in the fields to which this book contributes. While many of the chapters in this book explore energy and minerals and the abstractions and representations in their valuation, the world of the commodity trading houses (the likes of Glencore, Mercuria, or Trafigura) are for the most part absent. Yet this is a world of finance, investment banks, commodity exchanges, and new financial instruments all of which are almost archetypical instances of abstractive processes at work. To take the case of oil (but it is an extractive story), so-called first trades are the key moment at which oil produced (that is to say the upstream sector) enters the global market (the mid-stream sector) with its price tag. First trade or equity oil is acquired by a considerable variety of buyers and traders—from international oil companies (IOCs) with their large trading desks to the large commodity trading houses, small independents, and even other national oil companies. Commodity trading firms are all essentially in the business of transforming commodities in space (logistics), in time (storage), and in form (processing). Their basic function is to perform physical "arbitrages" which enhance value through these various transformations.

The scale of revenues generated from oil sales coupled with the lack of regulation on how these sales are conducted, creates enormous opportunity for value extraction and rent seeking. According to Global Financial Integrity unrecorded oil sales amount to seventeen billion annually (five hundred thousand barrels per day).[14] In 2016, OECD published a study that analysed 131 corruption cases involving foreign public officials in the natural resources sector, including trading. Significantly, twenty-six (20 percent) of the cases appeared to involve commodity trading. These figures refer only to the number of cases, not to the sums of money misappropriated and if the latter were considered, then the scale of corruption in the trading phase,

measured in terms of financial flows, would be greater still. Trade corruption involving Vitol, Philia and Gunvor in Congo, and Glencore in Kazakhstan have been well documented (see Public Eye 2017). On 26 February 2020 the Swiss Federal Council published a report on "Supervision of commodity trading activities from the point of view of money laundering," written in response to a postulate by the Council of States, that recognizes the high risk of corruption to which the commodity trading sector is exposed.[15] To the degree that many of the trading houses are not public and the oil commodity trading world is something of a "black box" of abstraction.

The menu of trading risks is broad, including not only the potential for tax evasion and money laundering associated with misinvoicing but also the possibility of bribery, collusion, and below-market pricing associated with the largely opaque oil-backed loans and oil-for-product swap agreements. In Nigeria, for example, a number of beneficiaries of export allocations are nothing but letterbox companies whose sole merit is that they are linked to high-ranking political officials or their entourage. Politically linked holders, "letterbox" or "briefcase" companies, have, as the Nigerian Task Force explained, little or no commercial and financial capacity. In Nigeria, such fake entities represent a major part of the "market." As pointed out by a Chatham House (2013) report, only 25 to 40 percent of the holders of export allocations actually have the capacity or will to finance, ship, and sell their cargo directly. The entire trading systems attracts many shadowy idle men and PEPs because these companies cater to individuals, serving as fronts for the political class and power brokers.

Although all commodity traders engage in transformation activities, they are tremendously diverse. Switzerland, which is the world's leading commodities trading hub with an estimated 35 percent share of the oil market, has over five hundred trading companies, almost 90 percent of which are private; 42 percent had less than ten employees and 10 percent more than three hundred (Chatham House 2013: 8). The five largest Swiss independent traders (Vitol, Glencore, Trafigura, Gunvor, and Mercuria) typically trade almost eighteen million barrels per day, equivalent to about 20 percent of global demand. There is no common pattern among in terms of the commodities they trade and transform, in the types of transformations they undertake, in their financing, and in their forms of ownership. Traders and sellers are often linked together in complex financial and joint-venture agreements. The trading assemblage is diverse not only in virtue of the nature of the sale contracts and price negotiations, but also because of the relations and networks linking companies, buyers, finance capital, audit

houses, and credit rating agencies. In engaging in these transformation activities, commodity traders face a wide array of risks, some of which can be managed by hedging, insurance, or diversification, but they face others that must be borne by the firms' owners. On a global canvas, much of the trading activity is centered on a cluster of global trading hubs (the UK, Netherlands, Singapore, Switzerland). Overall, the oil trading system is one of the most abstractive aspects of the global oil assemblage, and for that matter extractives in general.

Viewed through the lens of space and abstraction, the global oil trading *system* is intricate and byzantine, composed of varied assemblages of actors and their contrasting interests and positions within the commodity system operating across multiple regulatory jurisdictions. The trading system is moreover dynamic, market prices are capricious, and risks are legion: and not least the architecture of the system has changed, and is changing, in relation to global capitalism in its recent financialized forms, and in response to market volatility and global competitive pressures. Over the last four decades the system has experienced a thorough-going financialization (Gkanoutas-Leventis and Nesvetailova 2015; Gkanoutas-Leventis 2017). The 1980s liberalization and the institutional changes in the market triggered by the launch of commodity indexes by financial institutions in the early 1990s contributed to the growth of futures contracts and a raft of new actors. But recent market developments spurred by the introduction of permissive regulations in 2000 with the launch of the Commodities Future Modernisation Act (CFMA) in the US, opened the oil commodity markets in general to mutual funds, insurance institutions, and banks. Some of the largest investment banks, later known as "Wall Street Refiners," established specialized departments for trading in the oil market. By 2003 most of the biggest US hedge funds were engaged in commodity markets, their involvement tripling between 2004 and 2007. Finance and abstraction, as La Berge shows, are joined at the head.

As oil became an increasingly popular asset class with investors, it widened the opportunities for hedging but also for financial speculation in oil. Furthermore, the advance of financialization and the integration of financialized markets through indexification, produced endogenous dynamics in this market creating new sources of fragility and risk.[16] Sometimes called "oil vega," this financialization of oil and the rise of paper trades made oil prices both volatile and largely independent of physical trades and market fundamentals. At the same time, despite the plethora of regulatory agencies in global finance, regulatory arbitrage is a defining quality of the global financial sys-

tem permitting commodities markets to thrive in-between various regulatory niches, capitalizing on the permissive regulatory policies nationally, and exploiting unregulated spaces internationally (Gibbon 2004). Most traders operate in and through trading hubs or offshore financial centers associated with favorable regulation and tax rates, strong capital markets, a deep tradition of trade and shipping and human capital resources (London, New York, Chicago, Houston, Calgary, Tokyo, Hong Kong, Geneva, and Zug, and more recently the UAE and Singapore). Traders might be involved simultaneously in the buying, selling, transportation, storage, and refining of physical oil yet at the same time in value terms the overwhelming majority of trades are in so-called paper trades (the futures and derivative markets). In this hub and spoke network system, populated by a diverse suite of buyers, trading and financiers, it is the *opacity* that presents such a challenge to anti-IFF measures.

The oil trading assemblage is not just complex, variegated, global, and multi-scalar in its operations. It exhibits a number of distinctive properties, namely routing of finance through offshore financial centres (OFCs) and is marked by secrecy and lack of opacity. While the average proportion of group subsidiaries owned via OFC-based intermediated holding companies for the top one hundred global industrial firms (in revenues) was 18 percent, for energy traders the average was 29 percent for large integrated firms, and 96.7 percent for independent trading companies (Nesvetailova et al. 2021). The trading system seems to seek out, and even reproduce, opacity in its operations, operating in frontier-like (unregulated) spaces both within the oil producing states themselves but also in the trading hubs and OFCs. All this makes for a shadow world of unprecedented opacity.

Frontier conditions in which statehood may be limited are not only located at the rough and tumble oil producer end of the global value chain (as Bennett's chapter shows). These conditions are increasingly found at the other end of the oil (and other extractive) assemblage, in offshore financial centers, populated by shell and dormant companies and consolidated and encased by law, financial institutions, audit companies, and the like. In these frontier settings, extraordinarily capable expertise and resources are brought to bear to limit the possibilities for public authority to reach and regulate. In these OFC frontier zones it is evident that the "reach" of public authority is at best partial even in these thickly governed, high-capability regulatory environments such as Singapore or Zurich. They are abstractive zones par excellence.

*Arctic Abstractive Industry* seems to me to meet up in highly generative ways with the sorts of rethinking of extraction in an expanded sense. In this contact zone the Arctic can be seen as an instructive sort of frontier. It is a forcing house for all manner of new technics, indicators and audit functions, all draped in the language of both decay and becoming. The chapters in a variety of registers show, as Mason properly suggests, symbolic practice denies the sphere of material production its autonomy while at the same time rendering possible production to be extended to every part of the planet. The graph is not simply a graph, a picture of a polar bear not simply an image, a sensing device not simply a generator of indicators. Rather we are in the world of powerful and generative real abstractions, the immaterial construction of whole ways of life.

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## Notes

1. The word does appear in the University of Chicago's *Theories of Media Keyword's Glossary* (https://csmt.uchicago.edu/glossary2004/abstraction.htm) which I make use of here, along with Leigh Claire La Berge's (2014a) brilliant book *Scandals and Abstraction: Financial Fiction of the Long 1980s* and "The Rules of Abstraction" (2014b) in *Radical History Review*.
2. See also Mezzadra and Neilson (2017) on the multiple frontiers of extraction: excavating contemporary capitalism.
3. While acknowledging the importance of state sovereignty, they pull upon the work of Benton (2010) to emphasize the forms of quasi- or partial sovereignties, and the world of non-state petty sovereigns, to expose the fragmented and uneven complexities of contemporary capitalism.

4. In a very different register, albeit more sensitive to racialized extraction, Gomez-Barris offers a decolonial theoretical account "foregrounding submerged perspectives" (2017: 1) anchored in "anarcho-feminist Indigenous critique."
5. On the land appropriating state, see Schmitt (2003); and on the state as landlord see Hausmann (1981).
6. The proliferation of these rents means not only that they are the basis of capitalist expansion but are the objects of contest and struggle. For example, what group elites receives the import licenses, what ethnic groups are awarded the mining leases, who benefits from corporate community development projects and so on.
7. There is a large and sophisticated body of geographical work on critical geography, see Wood and Krygier (2009) and Pickles (2012).
8. See https://www.thearcticinstitute.org/arctic-economic-future-digital/; https://www.highnorthnews.com/en/2021-will-be-another-year-mostly-digital-arctic-conferences. See also a project involving Alexander Arroyo and myself and Professors Arthur Mason and Berit Kristofferson in Trondheim and Tromsø respectively entitled "The Digital Arctic," which is currently in progress.
9. The New Arctic & Digital Ocean (NADO) project was inaugurated in 2018 with support from the Peder Sather Center for Advanced Study and is led by the NADO community at NTNU, UC Berkeley, and UiT. A current project funded by Peder Sather involving Berit Kristofferson, Alexander Arroyo, and Michael Watts addresses the politics of the sea ice edge.
10. Relatedly see the critical oceans scholarship: DeLoughrey (2019); Rozwadowski (2018); Steinberg and Peters (2015).
11. Close to 5 million producing oil wells puncture the surface of the earth: 77,000 drilled last year, 4,000 offshore; 3,300 are subsea. There are by estimations over 40,000 oil fields in operation, more than 2 million kilometers of pipelines blanket the globe in a massive trunk-network and another 75,000 kilometers of lines transport oil and gas along the sea floor.
12. See https://www.miningreview.com/health-and-safety/the-digital-mine-how-miners-are-turning-a-vision-into-reality/.
13. See https://www.oilandgasiq.com/oil-gas/news/what-is-digital-transformation.
14. See https://www.futuredirections.org.au/publication/the-threat-of-organised-crime-to-the-oil-industry/.
15. Of the Swiss Federal Council, "Supervision of commodity trading activities from the point of view of money laundering," the Money Laundering Communication Office (MROS) shows that over the past ten years several thousand suspicious transactions related to trading. Two major international corruption scandals involving Brazilian and Venezuelan oil companies (Petrobras and PDVSA) alone resulted in more than 1,500 reports between 2015 and 2018. For the report, MROS evaluated a sample of 367 communications on suspicious transactions linked to trading between 2016 and 2018 (without taking into account Petrobras, PDVSA and other "laundromat cases"). These related to around 1.1 billion francs. MROS identified trading in fossil fuels as particularly risky accounting for 85 percent of the samples examined.

16. A substantial literature exists on oil and gas markets and the financialization, securitization, and speculation question; see Moors (2011) for complexities of price determination, also O'Sullivan (2009: 188).

## References

Adkins, Lisa. 2020. *The Time of Money*. Stanford: Stanford University Press.

Andreucci, Diego, Melissa García-Lamarca, Johah Wedeking, and Erik Swyngedouw. 2017. "'Value Grabbing': A Political Ecology of Rent." *Capitalism Nature Socialism* 28(3): 28–47.

Arbus, Diane. 2016. "Selections." In *Diane Arbus: Portrait of a Photographer* by Arthur Lubow. New York: Jonathan Cape.

Arias-Loyola, Martín. 2020. *Planetary Mine: Territories of Extraction under Late Capitalism*. London: Verso.

Arroyo, Alexander. 2021. *Designs for an Ocean: Transoceanic Imaginaries and Geographic Techniques of American Empire in the North Pacific and Bering Sea, 1867–1973*, PhD diss., University of California, Berkeley.

Ascher, J., P. Lazlo, and G. Quiviger. 2012. *Commodity Trading at a Strategic Crossroad*. Working Paper on Risk #39. London: McKinsey & Company.

Benton, Lauren. 2010. *A Search for Sovereignty: Law and Geography in European Empires 1400–1900*. Cambridge, UK: Cambridge University Press.

Bridge, Gavin. 2009. "The *Hole* World: Scales and Spaces of Extraction." *New Geographies* 2: 43–48.

Buck-Morss, Susan. 1995. "Envisioning Capital: Political Economy on Display." *Critical Inquiry* 21(2): 434–67.

Butler, Chris. 2016. "Abstraction Beyond a 'Law of Thought': On Space, Appropriation and Concrete Abstraction." *Law and Critique* 27(3): 247–68.

Chatham House. 2013. *Nigeria's Criminal Crude—International Options to Combat the Export of Stolen Oil*. London: Chatham House.

Christophers, Brett. 2019. "The Problem of Rent." *Critical Historical Studies* 6(2): 303–23.

———. 2020. *Rentier Capitalism*. London: Verso.

DeLoughrey, Elizabeth. 2019. "Toward a Critical Ocean Studies for the Anthropocene." *English Language Notes* 57(1): 21–36.

Friendly, Michael, and Howard Wainer. 2021. *A History of Data Visualization and Graphic Communication*. Cambridge, MA: Harvard University Press.

Fry, Hannah. 2021. "Maps without Places." *The New Yorker*, 21 June.

Gehl, Robert. 2012. "Real (Software) Abstractions: On the Rise of Facebook and the Fall of MySpace." *Social Text* 30(2): 99–119.

Gibbon, Peter. 2004. *Trading Houses during and since the Great Commodity Boom: Financialization, Productivization or . . . ?* No. 2014: 12, DIIS Working Paper. Copenhagen: Danish Institute for International Studies.

Gkanoutas-Leventis, Angelos. 2017. *Spikes and Shocks: The Financialization of the Oil Market from 1980 to the Present Day*. London: Palgrave.

Gkanoutas-Leventis, Angelos, and Anastasia Nesvetailova. 2015. "Financialisation, Oil and the Great Recession." *Energy Policy* 86: 891–902.

Gomez-Barris, Macarena. 2017. *The Extractive Zone*. Durham, NC: Duke University Press.
Halpern, Orit. 2015. *Beautiful Data*. Durham, NC: Duke University Press.
Harvey, David. 2006. *Limits to Capital*. London: Verso.
Hausmann, Ricardo. 1981. "State Landed Property, Oil Rent, and Accumulation in Venezuela." Phd diss., Cornell University.
Henely, Kalvin. 2012. "The Forgotten Space." *Slate*, 12 February. https://www.slantmagazine.com/film/the-forgotten-space/.
Johnson, Leigh. 2010. "The Fearful Symmetry of Arctic Climate Change: Accumulation by Degradation." *Environment and Planning D* 28(5): 828–47.
La Berge, Claire Leigh. 2014. "The Rules of Abstraction: Methods and Discourses of Finance." *Radical History Review* 118: 93–112.
———. 2016. "How to Make Money with Words." *Journal of Cultural Economy* 9(1): 43–62.
———. 2021. "The Future Perfect, Otherwise: Narrative, Abstraction and History in the Work of Fredric Jameson." *Historical Materialism* 29(1): 211–20.
Labban, Mazen. 2014. "Deterritorializing Extraction: Bioaccumulation and the Planetary Mine." *Annals of the Association of American Geographers* 104(3): 560–76.
Lapavitsas, Costas. 2009. "Financialised Capitalism: Crisis and Financial Expropriation." *Historical Materialism* 17(2): 114–48.
Lefebvre, Henri. 2005. *The Production of Space*. London: Routledge.
———. 2009. *Dialectical Materialism*. Minneapolis: University of Minnesota Press.
Mallarmé, Stéphane. 2012. *La Musique et les lettres.* Paris: Hach.Livre-Bnf.
Marx, Karl. 1973. *Grundrisse: Foundations of the Critique of Political Economy*. Harmondsworth: Penguin.
———. 1975. *Early writings*. Harmondsworth: Penguin.
Mazzucato, Mariana. 2018. *The Value of Everything: Making and Taking in the Global Economy*. London: Allen Lane.
McNeish, John-Andrew, and Judith Shapiro, eds. 2021. *Our Hyper-Extractive Age: Expressions of Violence and Resistance*. London: Routledge.
Mezzadra, Sandro, and Brett Neilson. 2017. "On the Multiple Frontiers of Extraction: Excavating Contemporary Capitalism." *Cultural Studies* 31(2–3):185–204.
———. 2020. *The Politics of Operations.* Durham, NC: Duke University Press.
Moors, Kent. 2011. *The Vega Factor: Oil Volatility and the Next Global Crisis*. New York: John Wiley & Sons.
Nesvetailova, Anastasia, Ronen Palan, Hannah Petersen, and Richard Phillips. 2021. *IFFS and Commodity Trading*. ERC/OECD. Lodon, UK: City, University of London.
O'Sullivan, Daniel. 2009. *Petromania: Black Gold, Paper Barrels and Oil Price Bubbles*. London: Harriman House Limited.
Paci, Enzo. 1969. "Dialectic of the Concrete and of the Abstract." *Telos* 3: 1–18.
Park, Stephen. 2003. "Abstraction." Theories of Media. Retrieved June 20, 2021, from https://csmt.uchicago.edu/glossary2004/abstraction.htm.
Pickles, John. 2012. *A History of Spaces: Cartographic Reason, Mapping and the Geo-Coded World*. London: Routledge.
Piketty, Thomas. 2014. *Capital in the Twenty-First Century*. Cambridge, MA: Belknap Press.

Postone, Moishe. 1993. *Time, Labor, and Social Domination: A Reinterpretation of Marx's Critical Theory*. Cambridge, UK: Cambridge University Press.
Public Eye. 2017. *Gunvor in Congo: Oil. Cash and Misappropriation of a Swiss Trader in Brazzaville.* Retrieved from https://www.publiceye.ch/fileadmin/doc/Rohstoffe/2017_PublicEye_Gunvor_in_Congo_Report.pdf.
Rozwadowski, Helen. 2018. *Vast Expanses: A History of the Oceans*. London: Reaktion Books.
Schmitt, Carl. 2003. *The Nomos of the Earth*. New York: Telos Press.
Serreze, Mark. 2018. *Brave New Arctic*. Princeton: Princeton University Press.
Standing, Guy. 2016. *The Corruption of Capitalism: Why Rentiers Thrive and Work Does Not Pay*. London: Biteback.
Stanek, Lukasz. 2008. *Henri Lefebvre: Space, Difference, Everyday Life*. London: Routledge.
Steinberg, Philip, and Berit Kristoffersen. 2017. "'The Ice Edge Is Lost . . . Nature Moved It': Mapping Ice as State Practice in the Canadian and Norwegian North." *Transactions of the Institute of British Geographers* 42(4): 625–41.
Steinberg, Philip, and Kimberley Peters. 2015. "Wet Ontologies, Fluid Spaces: Giving Depth to Volume through Oceanic Thinking." *Environment and Planning D: Society and Space* 33(2): 247–64.
Swedberg, Richard. 2020. "On the Use of Abstractions in Sociology: The Classics and Beyond." *Journal of Classical Sociology* 20(4): 257–80.
Toscano, Alberto. 2008. "The Culture of Abstraction." *Theory, Culture & Society* 25(4): 57–75.
Toscano, Alberto, and Jeff Kinkle. 2015. *Cartographies of the Absolute*. London: John Hunt Publishing.
Williams, Raymond. 1985. *Key Words*: *A Vocabulary of Culture and Society*. New York: Forth Estate.
Wood, Denis, and John Krygier. 2009. "Cartography: Critical Cartography." In *International Encyclopedia of Human Geography Oxford,* 345–57. London: Elsevier.

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