

ACCOUNTING

Issue 05

The Society for the Diffusion of Useful Knowledge

July 2019



A billet of highly enriched uranium recovered from Y-12 National Security Complex, Oak Ridge, Tennessee. Included in Randy Lee Cutler's, *An Elemental Typology*, 2019. COURTESY THE ARTIST.

account (n.)

c. 1300, "**counting**," especially "**reckoning of money received and paid**, detailed statement of funds owed or spent or property held," from Old French *acont* "(financial) account, reckoning, terminal payment," from Late Latin *computus* "**a calculation**," from *com* "with, together" + *putare* "to reckon," originally "to prune," from "**to cut, strike, stamp**." From the notion of "rendering an account" comes the sense "statement answering for conduct" (mid-14c.) and the general sense "**narration, recital of facts**."

account (v.)

c. 1300, "to count, **enumerate**," from Old French *aconter* "to enumerate; reckon up, render account" (Modern French *conter*), from *a* "to" + *conter* "to count, tell". Sense of "**to explain, justify**" (c. 1300) is from notion of "present a detailed explanation of money, etc. held in trust." Sense of "**to value**, to estimate" (to account as belonging to a certain class of quality) is from late 14c.

The Society for the Diffusion of Useful Knowledge is a serial broadsheet publication produced by the Blackwood Gallery, University of Toronto Mississauga, as part of *The Work of Wind: Air, Land, Sea*, a site-specific exhibition, public program, and publication series designed to expand perspectives on climate change through artistic practices, cultural inquiry, and political mobilization.

The Work of Wind: Air, Land, Sea

Exhibition: 14–23 September 2018
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The Work of Wind: Air, Land, Sea aims to foster a deeper public awareness of the complex entanglements of ecologies of excess, environmental legacies of colonialism, the financialization of weather, contemporary catastrophism, politics of sustainability, climate justice, and hopeful resilience. It sets out to develop durable visual-cultural literacies and invites publics to create new encounters in the common struggle for a future. The project flows across the city of Mississauga and is distributed locally, nationally, and internationally through a three-volume book series co-published with K. Verlag and *The Society for the Diffusion of Useful Knowledge*, an innovative public program and publishing platform.

The Society for the Diffusion of Useful Knowledge (SDUK)

In order to productively collide with the present crisis, we recognize that ideas cannot be constrained by disciplines. *The Society for the Diffusion of Useful Knowledge* (SDUK) composes and circulates an ecology of knowledge based on the relationship and antagonism of “useful” ideas. The name of this innovative platform is borrowed from a non-profit society founded in London in 1826, focused on publishing inexpensive texts such as the widely read *Penny Magazine* and *The Library of Useful Knowledge*, and aimed at spreading important world knowledge to anyone seeking to self-educate. Both continuing and troubling the origins of the society, the Blackwood Gallery’s SDUK platform brings artists, scientists, activists, and publics into an interdisciplinary, intercultural, intergenerational reassessment of the history of capitalism and colonialism and their environmental legacies in the present.

The **SDUK** broadsheet series brings together contributors from diverse fields in the sciences and humanities, students and faculty from across the University of Toronto Mississauga, community organizations and activists, policy makers and policy agitators, artist researchers and speculative thinkers, all to advance new forms of literacy around climate change discourse.

The Work of Wind: Air, Land, Sea

Curated by Christine Shaw
 Presented by the Blackwood Gallery in partnership with the University of Toronto Mississauga, the City of Mississauga, and K. Verlag.
 2018–2019



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An Elemental Typology

Randy Lee Cutler

Taking the scientific grid as a point of departure, Cutler’s typology traces the prolix potential of collapsing scientific, industrial, philosophical, spiritual, and informal knowledge practices alongside images from the public domain into new mineralogical arrangements (see cover). This fictive inventory draws on real data to generate an archaeological dig across geographies and histories and in the process, renders visible new architectures of time and matter. Collecting and reassembling these phenomena, scientific truth is folded into the irrational, the fabricated, and the blithely intuited wherein mineral infrastructures permeate both the physical and conceptual layers. Working with four distinct and non-hierarchical categories (see p. 16–19), this data mining is stratified for the purposes of condensation and displacement, elucidation and transformation. Ultimately, these borrowed images and the specific stories they uncover are adapted towards new formations, allowing for an emergent legibility of a world beyond words where matter matters.

How to Read this Broadsheet

This fifth SDUK broadsheet examines the multifaceted meanings of **ACCOUNTING** in the age of climate change. This issue considers accounting in its colloquial sense, pertaining to investment and economics, but also moves beyond the ledger book to consider what remains uncounted, and what is consciously left out. Throughout this issue, we find slippery concepts, things, and actors that pose a challenge to accounting as a means of representation and understanding.

Beginning with economics, one might ask: **What are the basic tools and assumptions on which accounting is based?** In his ongoing unsettling of fundamental economic concepts, D.T. Cochrane looks at how prices are set and upheld (p. 24). Meanwhile, in Randy Lee Cutler’s *An Elemental Typology*, the familiar grid format of a balance sheet is reimagined to consider how minerals and stones have been given value and significance (cover; p. 3, 16–19).

As many contributors to this issue suggest, decisions about **what does and doesn’t get counted** are entangled in our socio-political worlds. Kristen Simmons’ *Settler Atmospheric*s queries how toxic atmospheres are created and maintained at

Standing Rock, North Dakota (p. 10). Kelly Wood’s *Fugitive Pollutions* extends these concerns to Southern Ontario, photographing industrial air pollution that is often posited as an unavoidable by-product of business activity (p. 10). Fraser McCallum’s column explores the elusiveness of dust, taking up the concept of externality examined throughout this issue (p. 25).

Readers who are policy-minded may wonder: **How are industries and regulators holding one another accountable in light of a changing climate?** A profile of the Ontario Clean Air Alliance by Kristen Schaper (p. 21) provides a case study, while the regulatory frameworks of aviation industry emissions are addressed by Laurel Besco (p. 20), and a profile of Musket Transport considers what can be done to mitigate pollution in the freight trucking industry (p. 22).

How can accountability be upheld and demanded? Several contributions address this question by looking at institutions: Camille-Mary Sharp interrogates museum sponsorship practices (p. 13); Regan de Loggans and Maria Hupfield of the Indigenous Womxn’s Collective demand accountability of the Whitney Museum’s Board of Direc-

tors through performative protest (p. 12); and James K. Rowe and Alexis Shotwell address the investments made by the Canada Pension Plan on behalf of Canadian citizens (p. 4). Finally, Steve G. Hoffman shines light on the often-overlooked field of Disaster and Emergency Management (p. 8), while calling for greater community accountability in that profession.

Some readers may wonder: **How can we think about value without the need to quantify and enumerate it?** Through close attention to subtle weather patterns, and the emotional states they provoke, J.R. Carpenter’s poetry (p. 14) records natural phenomena that are felt, but rarely recorded. Adam Dickinson’s image-poems perform a similar gesture; in his case, examining the unseeable worlds of microbial cultures (p. 6).

Finally, this broadsheet closes with profiles of organizations throughout the GTHA (p. 26), whose diverse work—from poverty alleviation to energy retrofitting—creates valuable local change in ways that can’t always be quantified. Likewise, our glossary builds a set of terms whose meanings are multiple and complex, highlighting how *accounts* are also narrative stories.

Vampirement: How the Canadian Pension Plan Investment Board Feeds on Some Futures to Secure Others

James K. Rowe and Alexis Shotwell

Wet'suwet'en people have never ceded their land through treaty; like many Indigenous people they continue to practice relations of responsibility with the places and beings that give them life, including protecting them from ecological devastation. In January 2019, the RCMP raided Wet'suwet'en territories to end their blockade of the Coastal GasLink pipeline, which is meant to transport fracked gas from northern British Columbia to the west coast. Images of heavily armed RCMP forcibly removing and arresting land protectors in service of a planet-destroying fuel source were a stark reminder of how colonialism still reigns, even in an age of putative reconciliation. Immediately following the RCMP's invasion, fierce protests powered by Indigenous people and settler allies sprung up across the country demon-

strating solidarity with Wet'suwet'en land and water-protectors. Images of these solidarity events gesture towards real decolonization: honouring Indigenous law and governance over their lands.

Many of us who participated in these events—whether Indigenous or settler Canadians—don't know that we are owners of the very company violating Wet'suwet'en law: TransCanada. We own this company as “beneficiaries” of the Canadian Pension Plan (CPP).

The CPP was first created in 1966. In 1997, the Canadian Pension Plan Investment Board (CPPIB) was established to move the plan towards financial markets. It is now the largest pool of investment capital in Canada, totalling approximately \$390

billion. The longstanding goal of the plan is to help secure dignified retirements for Canadians. But as the TransCanada example reveals, the CPPIB values settler futures considerably higher than Indigenous ones. All of us who pay into the plan contribute to this painful continuation of colonial devaluation and dispossession.

Almost simultaneously with the RCMP raids on Wet'suwet'en territories, people worldwide were horrified to learn of how Trump's immigration policy pursued family separation and the imprisonment of children. In response, Canadian Prime Minister Justin Trudeau noted with disapproval that “obviously, this is not the way we do things in Canada.”¹ And yet, this is precisely how we do things in Canada: we actively house children in immi-

grant detention centres and separate children from their parents who are detained there.² The CPPIB also invests in private prison companies in the U.S. that run immigrant detention centers.³ In other words, the CPPIB generates value for some Canadians from the devaluation of immigrant life.

CPPIB's tobacco company investments (such as Philip Morris) exemplify another facet of this vampiric feeding on Indigenous, racialized, and poor people's futures. The great majority of smokers are from low-income families, and this is partly because the companies target lower-income neighbourhoods (with product placement in a disproportionate number of retailers, for example).⁴ By staying invested in big tobacco, the CPP is securing some futures by diminishing others.

All working Canadians who contribute can draw from the plan, but contributions and payouts are determined by income. In other words, higher-income earners end up benefitting more (and the plan is no help to those—mostly women—who do unpaid care work). The CPPIB is supposed to be securing dignified retirement for all waged Canadians, but its portfolio tells a different story; currently the plan helps to secure futures for more affluent settler Canadians at the expense of immigrants, Indigenous people, and poor people. And these latter two groups are required to pay into a fund that invests their futures away.

Furthermore, the CPPIB's carbon-heavy investments threaten to undermine the ecological foundation of *every* Canadian's future. But of course, Indigenous, racialized, and poor people—whether in Canada or worldwide—already bear the brunt of intensifying climate change. The Intergovernmental Panel on Climate Change (IPCC) cautioned in their most recent report that “limiting global warming to 1.5°C, compared with 2°C, could reduce the number of people both exposed to climate-related risks and susceptible to poverty by up to several hundred million by 2050.”⁵ And yet the CPPIB has over \$4 billion invested in 79 of the largest fossil fuel (oil, gas, and coal) companies. The CPPIB's current fossil fuel investments are wildly incongruent with the earth's carbon budget—the amount of carbon that human society can burn before the 1.5°C limit is reached. Even if you personally support strong action on climate change, your pension contributions are eating away at the future they are meant to secure.

At first glance, the CPPIB's unjust investments are little different from Trudeau's Liberals using tax dollars to buy a pipeline that violates Indigenous sovereignty while intensifying climate change (even if you vigorously protested the Kinder Morgan expansion, you now own it). A key difference, however, is that government budgets remain bounded by some democratic accountability. The electorate can still vote governments out—though the electoral process is highly constrained by con-

centrations of corporate power that shape outcomes with lobbying, media control, and campaign contributions. In contrast, the CPPIB's portfolio is entirely free from democratic accountability; beneficiaries pay in and receive benefits, but have zero say over investments. Indeed, the CPPIB presents their “investment-only” mandate as a significant advantage: “CPPIB's decisions are not influenced by government direction; regional, social or economic development considerations; or any non-investment objectives.”⁶ In other words, unsullied by democratic accountability, the CPPIB is freed up to maximize profits no matter the social or ecological cost. Unsurprisingly, those costs are disproportionately borne by Indigenous, racialized, and working-class people.

As the country's largest pool of investment capital (\$390 billion), the CPP is a crucial engine of racial capitalism, colonial dispossession, climate injustice, and working-class immiseration in Canada and abroad. This reality is especially dispiriting since public pensions were the product of working-class organizing in the nineteenth and twentieth centuries. Now, worker retirement income is tied up in a system that undermines workers, Indigenous sovereignty, immigrants, and the ecological foundations of a generalized futurity.

It doesn't have to be this way.

The existential threat posed by climate change is reason enough to rethink many of our collective institutions, including pensions (which comprise over half of global investment capital). The Green New Deal being forwarded by the Sunrise Movement and Justice Democrats in the U.S. is inspiring in this regard. Green New Deal visioning in Canada⁷ should include a definancialized and universal pension program that supplies dignified retirements for all—no feeding on some futures to secure others.

Kevin Skerrett (from the Canadian Union of Public Employees) and Sam Ginden (formerly from the Canadian Auto Workers) have done excellent work outlining the practicalities of such a plan, and their proposal for a new model does not rely on markets (shareholder returns from large corporations).⁸ It also dramatically increases benefits while extending them to those who have performed vital care work outside of the waged labour market. Their plan is funded through taxation revenue and beneficiary contributions and is entirely achievable. It is important to recall that the CPP only started relying on financial markets to secure retirements in 1997, and this can be undone. These markets and their pursuit of shareholder returns are the primary drivers of colonial dispossession, climate injustice, and capitalist exploitation; those of us who contribute to the CPP are forced accomplices to these exploits. Let's organize into existence an alternative that is truly accountable to the futurity of all.

1 Amanda Connolly, “‘What's Going on in the United States Is Wrong': Trudeau Adds Voice to Chorus Condemning Trump,” *Global News*, 20 June 2018, <https://globalnews.ca/news/4285443/justin-trudeau-donald-trump-child-detention-cages>.

2 National Directive for the Detention or Housing of Minors, CBSA, <https://www.cbsa-asfc.gc.ca/security-securete/detent/nddhm-dndhm-eng.html>; Quarterly Detention Statistics, 2017–2018, CBSA, <https://www.cbsa-asfc.gc.ca/security-securete/detent/qstat-2017-2018-eng.html>; Hanna Gros, *Invisible Citizens: Canadian Children in Immigration Detention* (University of Toronto Faculty of Law, 2017), https://ihrp.law.utoronto.ca/utfl_file/count/PUBLICATIONS/Report-InvisibleCitizens.pdf.

3 Max Siegelbaum, “‘Deeply Concerning': Canadian Pension Fund Invests in US Immigration Detention Firms,” *The Guardian*, 12 October 2018, <https://www.theguardian.com/world/2018/oct/12/canada-pension-fund-invests-in-us-immigration-detention-firms>.

4 William Wan, “America's New Tobacco Crisis: The Rich Stopped Smoking, the Poor Didn't,” *The Washington Post*, 13 June 2017, https://www.washingtonpost.com/national/americas-new-tobacco-crisis-the-rich-stopped-smoking-the-poor-didnt/2017/06/13/a63b42ba-4c8c-11e7-9669-250d0b15f83b_story.html.

5 Intergovernmental Panel on Climate Change, “Summary for Policymakers,” <https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers>.

6 “Investing Responsibly for CPP Contributors and Beneficiaries,” CPP, 2018, https://www.cpplib.com/documents/1922/CPPIB_SI_2018_ENG.pdf.

7 Pact for a New Green Deal, <https://greennewdealcanada.ca/>

8 Kevin Skerrett, Chris Roberts, Johanna Weststar, and Simon Archer (eds.), *The Contradictions of Pension Fund Capitalism* (Ithaca: Cornell University Press, 2018), <http://www.cornellpress.cornell.edu/book/?GCOI=80140100837830>.



At the time I advanced to speak to Moctezuma, I took off from my neck a collar of pearls and glass chapelets and put it around his neck. After having proceeded along the street, one of the servants came bringing two letters, written in Spanish, enclosed in a roll of cloth, which were made from the shells of colored peewees or parivinkles, held together in high estimation, and from each corner descended two golden peewees, finished in a very perfect manner about foot and a half in length. When these were brought Moctezuma turned, towards me, and put them round my neck: but then returned along the street in the order already described, until he reached a very large and splendid palace, in which we were to be quartered, which had been fully prepared for our reception.

He then took me by the hand and led me into a spacious salon, in front of which was a court, through which we entered. Having caused me to sit down on a piece of rich carpeting, which we had ordered to be made for his own use, he told me to wait his return here, and then went away. After a short space of time, when his people were all bestowed in the quarters, he returned with many and various jewels of gold and silver, feather work, and five or six thousand pieces of cotton cloth, very rich and of varied texture and finish.

After having presented these to me, he sat down on another piece of carpet that had placed for him near me, and being seated he discoursed as follows:



Bamban, Ban, Beans, Benjamins, Big ones, Bills, Boffo, Bones, Booty, Bread, Bucks, C-note, Cabbage, Cake, Cents, Cheetah, Cheesecake, Chumpchange, Clams, Coin, Cream, Dancy, Dead presidents, Dibs, Dinero, Dime, Dough, Doubles, Doubloons, Duckets, Flesh, Float, Fins, Five-spots, Fivers, Folding stuff, Froggie, Fun-tickets, Green, Greenbacks, Gs, Grand, Gravy, Honor, Jack, Keesa, King's ransom, Large, Lettuce, Long green, Lories, Lot, Lucre, Lumber, Noolah, Nickel, One Paper, Payola, Plaster, Pop guns, Round, Quarter, Quid, Roll, Sawdust, Scratch, Scip, Shekels, Shapnel, Simoleons, Singles, Skrilla, Shugs, Snacker, Snake, Smoosi, Spondulx, Stacks, Sugar, Tender, Teachers, Ten-spots, The root of all evil, Two bits, Wad, Wampum, Yams

GERM

Adam Dickinson

Metabolism accounts for the set of life-sustaining chemical reactions that occur within an organism. The metabolism of a body, however, is necessarily connected to the metabolism of the planet and its circulation of energy, resources, and capital. All of us carry within us the chemical pollution resulting from global dependence on fossil fuels. Similarly, the shifted microbial communities of the Western diet are increasingly visible in the bodies and metabolic processes of people around the world.

I conducted biomonitoring and microbiome testing on my body in order to produce a book of poetry, *Anatomic*¹ that re-frames the body (my body) as a being overwritten by toxic chemicals yet constantly subject (in necessary ways) to the biosemiotic interference of other microbial life forms. As part of this work, I swabbed bacteria from my body and from selected surfaces and cultured it on top of various texts in order to generate poems that involve microbes in the writing process.

“Court” (left) involves a quotation from Cortes’ second letter to Charles V describing his meeting with Moctezuma in Mexico on 8 November 1519. It is colonized with bacteria that I swabbed from money and swabbed from my hands after touching money. The crowd of microbes, the result of the interaction between bodies and systems of exploitation and exchange, has been invited here to participate in the creation of an erasure text.

“Scratch” (right) presents a list of colloquial synonyms for money. This text is colonized by bacteria swabbed from money. Phthalates, a class of endocrine disrupting chemicals (hormone mimics) common on receipts and often transferred to the surfaces of banknotes while being collected in wallets, are present but not visible.

¹ Adam Dickinson, *Anatomic* (Toronto: Coach House Books, 2018).

Broadening the Imaginary in Disaster Management

Steve G. Hoffman

Disaster managers spend most of their time inhabiting imaginary worlds. Rather than respond directly to emergencies, which are by definition rare events, these professionals focus their daily work on accounting for the human and infrastructural consequences of potential emergency and disaster scenarios such as ice storms, tornadoes, floods, train derailments, or chemical plant explosions. They then develop training modules, simulation exercises, planning documents, and cross-agency relationships that reflect their educated guesses about the hazards we are likely to face and how to best manage their inherently uncertain impacts. In my ongoing interview and observational study of the disaster management profession in the Greater Toronto Area, I have been struck by the creativity, imagination, and openness involved in this accounting work. I have also been struck by how narrowly confined these interventions tend to be.

Disaster and Emergency Management, or DEM, is a professional field organized around the coordination of resources and responsibilities in the preparation for, response to, and recovery from specific emergencies and large-scale disasters. DEM offices are typically located at municipal, regional, provincial, and federal levels of Canadian government, or city, county, state, and federal levels in the United States. The DEM professionals I have been fortunate to spend time with tend to be deeply invested in building networks and listening to those ideas that will help us save lives and money. Yet they tend to place an overriding emphasis on dealing with emergency events (e.g. a multiple-vehicle collision, building fire, or chemical spill) and specific disasters (e.g. a flood, ice storm, or tornado), rather than thinking at the level of ecological and social structural systems. Furthermore, the overriding goal is almost always to rebuild the status quo, so that those individuals, groups, and communities impacted by an emergency or disaster can regain a sense of normalcy as quickly as possible. Given the increasingly dire impacts of global climate change over the coming decades,

these professionals would do well to start thinking beyond how to protect a status quo that continues to create the very ecological crisis we now face. Our communities, cities, and regions are poorly equipped to cope with the chronic but slow-building consequences of climate chaos. The DEM profession would prove more vital in this moment if it were to shift from planning for and managing specific emergency and disaster events and toward planning for and building more sustainable, resilient, just, and symbiotic systems of human existence.

Is this too much to expect from DEM professionals? Maybe, but keep in mind that DEM is different from first response. Unlike first responders (i.e. fire patrols, paramedics, and the police), DEM professionals play a coordinating role before, during, and after a disaster. As the director of Brampton's Emergency Management Office described to me about his agency's work, "We have an understanding that [...] when we're activated, anything that happens inside the yellow tape is theirs [first responders]. Anything that's outside the yellow tape is ours." Outside the yellow tape, it turns out, involves an ever-expanding realm of service coordination. DEM professionals are responsible for evacuations, and so spend a lot of time working long before a disaster event with transportation, hotels, and shelters to develop interoperable contingency plans for quickly moving large numbers of people out of their homes and into safe dwellings. Disaster managers also handle crisis communications, and so not only disseminate information during a disaster but more mundanely conduct training exercises that test communication protocols and technologies with specialists. Not only do DEM professionals need to stay on top of current communication technologies, but they must also maintain ongoing relationships with a wide variety of service-providers and representatives of various city agencies that may be called into action. DEM officials are also responsible for informing elected officials and escorting VIPs at a disaster site, such as the mayor, premier, city council members,

or an MP. This means that they have to deal with political chicanery before, during, and after a catastrophe.

My main point is that the scope of "anything that's outside the yellow tape" is growing. Among the many ominous trends of the early twenty-first century has been the increasing number of large-scale disasters. In general, environmental, organizational, and technological disasters have grown more costly around the globe, impact larger numbers of people, and visit their most disruptive and tragic consequences on the poorest and most marginalized human populations.¹ Extreme weather events—hurricanes, tornadoes, tsunamis, flooding, ice storms, wild fires—have become the numbingly familiar signs of chaotic global climate trends. These events are only getting more common, complex, and destructive as we careen toward the kinds of critical ecological tipping points that environmental activists have been warning us about for well over three decades.² To deal effectively with this rather dire state of affairs, the field of DEM has started to shift from short-term recovery and toward programs rooted in "adaptive resilience."³ On the face of it, then, it might not seem too difficult to move beyond "resiliency" and toward engendering more sustainable forms of living that address the structural conditions producing such unequal exposure to risk in the first place.

The problem is that DEM has long been hemmed in by formal governance procedures and reporting mechanisms that define success as returning communities to their pre-disaster situation. A tightly scoped managerial approach to disaster relief grew from mid-twentieth century civil defense efforts. Shortly after World War II and with the onset of the Cold War, Canada and the United States built programs focused on protecting their civilian populations from possible air raids and nuclear attack. This history rooted the profession of DEM in a "command and control" foundation that has proven difficult to shift. In the post-9/11 era of security concerns, all major municipalities in

Canada and the United States are mandated to keep emergency plans updated and assign a coordinator in charge of their execution. In practice, this means that every mid-sized and larger city in North America has a designated office of disaster and emergency management with a professional staff focused on mobilizing managerial expertise toward reducing the economic, human, infrastructural, and bio-physical costs of a broad variety of attacks, be they conflict-based, extreme weather events, or health, industrial, and technological catastrophes.⁴ Every municipality also has to conduct at least one full-scale annual exercise that trains key staff across municipal agencies in emergency response. Emergency management offices are typically accountable to the fire or police chief, who maintains disaster recovery systems and is accountable to the mayor's office, who is accountable to state or provincial government, who is accountable to their federal governments—all of whom are (ideally and in the abstract, at least) accountable to voting publics. At the same time, DEM has become highly professionalized over the last two decades, with the rapid growth of degree and certification programs, membership associations, local, national, and international conferences, and various modes for disseminating professional knowledge.

In order to shift DEM from managing events to building more resilient, just, and sustainable systems, provincial and municipal mandates could include expectations that critical, local activist, and subaltern perspectives are voiced at the planning tables of government offices of emergency management. Similarly, DEM educators can draw from a much broader array of critical theoretical perspectives that connect the *longue durée* of colonial and post-colonial disregard for Indigenous knowledge, entrenched organizational interests, a pro-growth urban power elite, regulatory capture, corporate power, disaster capitalism, and structural inequalities to the social and economic production of disaster vulnerability.⁵ However, more pressing than better critical theorizing: DEM professionals, along with policymakers at all levels of government, should develop long-term climate adaptation plans that account for subaltern knowledge and vulnerable populations in their proposals and training exercises. Disaster planning needs the direct input of Indigenous community leaders, environmental justice activists, critical-thinking artists, members of underserved communities such as homeless and under-housed populations, skeptics of pro-growth development schemes, and other marginalized dreamers, who, I believe, are best equipped to envision better ways of collective living precisely because the status quo has largely failed them. These are the voices who will propose better ways to live with all tomorrow's catastrophes. We'd better engage their expertise.



German students from Berlin and surrounding areas gather in January 2018 for weekly #FridaysForFuture protests to seek climate justice. PHOTO: JÖRG FARYS. THIS IMAGE IS LICENSED UNDER CREATIVE COMMONS (CC BY 2.0).

1 See Damon P. Coppola, *Introduction to International Disaster Management, Third Edition* (Waltham, MA: Butterworth-Heinemann, 2015), 18-30; and IPCC, "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I & II of the Intergovernmental Panel on Climate Change," (Cambridge, 2012).

2 See John Bellamy Foster, "The Great Capitalist Climacteric: Marxism and System Change Not Climate Change," *Monthly Review* 67, no. 6 (2015): 4-48.

3 See Kathleen Tierney, *The Social Roots of Risk: Producing Disasters, Promoting Resilience* (Palo Alto, CA: Stanford University Press, 2014).

4 See Thomas A. Birkland, *Lessons of Disaster: Policy Change after Catastrophic Events* (Washington DC: Georgetown University Press, 2006); Scott Gabriel Knowles, *The Disaster Experts: Mastering Risk in Modern America* (Philadelphia, PA: University of Pennsylvania Press, 2012); and Jennifer Wilson and Arthur Oyola-Yemaiel, "The Evolution of Emergency Management and the Advancement towards a Profession in the United States and Florida," *Safety Science* 39 (2001): 117-131.

5 For overviews, see Amitai Etzioni, "The Capture Theory of Regulations—Revisited," *Society* 46 (2009): 319-323; William Freudenberg, Robert Gramling, Shirley Laska, and Kai Erikson, *Catastrophe in the Making: The Engineering of Katrina and the Disasters of Tomorrow* (Washington: Island Press, 2009), especially chapter 4; John Hannigan, *Environmental Sociology, Third Edition* (London and New York: Routledge, 2014), 143-153; Antony Loewenstein, *Disaster Capitalism: Making a Killing Out of Catastrophe* (London: Verso Books, 2015); Raj Patel and Jason W. Moore, *A History of the World in Seven Cheap Things: A Guide to Capitalism, Nature, and the Future of the Planet* (Berkeley, CA: University of California Press, 2017); and Tierney, *The Social Roots of Risk*, chapter 5.

Settler Atmospheric

Kristen Simmons



Kelly Wood, *Ontario air pollution #3 [Sarnia]*, 2012. Inkjet colour photograph. COURTESY THE ARTIST.

Breathing in a settler atmosphere is taxing. Some of us can't breathe. In the fall of 2016 many of us watched shaky Facebook video livestreams that resembled a warscape of heavy military equipment and smoke. Standing Rock and the Mni Sose (Missouri River) were choke points for water protectors asserting Indigenous sovereignty, and sites for violent, experimental techniques of control used by police and private security forces.

I went to Standing Rock twice in November 2016 to be in good relation. I went in keeping with Kim TallBear's proposal to approach kinship as "a partial and productive tool to help us forge alternatives to the settler-colonial state."¹ As many Indigenous scholars have articulated, relational ethics are based in reciprocity and

obligation with the land and other-than-humans. Glen Coulthard describes this place-based foundation of indigenous decolonial thought and practice as *grounded normativity*, which ought to "inform and structure our ethical engagements with the world."²

The conditions we breathe in are collective and unequally distributed, with particular qualities and intensities that are felt differently through and across time. For Indigenous nations, the imbrications of U.S. militarism, industrialism, and capitalism have always been palpably felt on Indigenous lands and through Indigenous bodies, from extraction to experimentation. The regimes of this foundational violence are the surrounds of settler atmospherics. Christina Sharpe argues that

antiblackness is as pervasive as the climate.³ This, too, is the surround of settler atmospherics. Put otherwise, settler atmospherics are the normative and necessary violences found in settlement—acquiring, adapting, and constricting Indigenous and Black life in the U.S. settler state.

One of the technologies of governance that capacitated this violence at Standing Rock was the Emergency Management Assistance Compact (EMAC), which authorizes states to enter into agreements with other states in order to share emergency management personnel during crisis situations. With some seventy-six law-enforcement agencies from ten states dispatched over a four-month period, the compact turned Standing Rock into "a sort of law-enforcement laboratory."⁴ Outside of natural disasters, EMAC has thus far only been used to handle the crisis of Indians and the crisis of the Black Lives Matter movement. Joseph Masco argues that the very notion of crisis is in crisis, and that crisis has become a counterrevolutionary idiom in the twenty-first century: "Crisis talk today seeks to stabilize an institution, practice, or reality rather than interrogate the historical conditions of possibility for that endangerment to occur."⁵ The construction of Standing Rock as a crisis ruptures history and installs an event-based logic, rather than inviting structural interrogation. It ruptures our relations. As Nick Estes argues, the #NoDAPL struggle is a continuation of the Indian Wars and of the settler colonial project of Indigenous elimination. What, we should ask, is made to get lost? What gets obfuscated? What gets disavowed? What gets refused?⁶

Tear gas and pepper spray (both riot-control agents) became the dominant crowd-control tactics deployed against nonviolent water protectors at Standing Rock. Riot-control agents are defined in the 1993 Chemical Weapons Convention as "any chemical [...] which can produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure."⁷ The Convention banned these agents as a method of warfare internationally, but their use is paradoxically permitted by domestic law enforcement.⁸ The U.S. Supreme Court decisions known as the Marshall Trilogy nest Indigenous nations in a "cramped space" through their designation of "domestic, dependent nations," rendering the use of tear gas and pepper spray on unarmed protectors at Standing Rock permissible.⁹

A Freedom of Information Act public records request uncovered a 133-page "field force operations" training manual from the Federal Emergency Management Agency's Center for Domestic Preparedness, which was sent between law enforcement personnel in North Dakota.¹⁰ The manual describes riot-control agents as designed to accomplish five tasks: disrupt, disorient, disable, distract, and disperse. It lists the three most commonly used types: chloroacetophenone, orthochlorobenzaldehyde malononitrile (both colloquially known as tear gas), and oleoresin capsicum, or pepper spray. The manual is not much for chemical specificity, noting that "all of these agents produce about the same effects," emphasizing the immediacy and temporariness that allow them to sever the present.

At the actions in which I participated riot-control agents were used in spray form, and water protectors did what they could to shield themselves with the materials at hand: cloth bandannas, surgical masks, goggles. These materials could be picked up at various stations around camp by those who didn't come prepared. People leaving the action to go back to camp would often pass off what they had. However, most techniques were insufficient for fully protecting against exposure and treating injuries in the aftermath became key. Medics would treat exposures with a 50/50 mixture of liquid antacid and water to soothe the eyes, nose, and mouth. On 20 November, which became known as Backwater Sunday, over 300 people suffered injuries, and most suffered both from hypothermia and chemical exposure. Pepper spray was mixed with water in the water cannons and tear-gas canisters were deployed as projectile weapons, fired directly at protectors at close range. Medics described how the mixture the police were using pooled on the asphalt road and froze as black ice in the freezing temperatures.

A horrifying email chain with the subject line "Fwd: Israelis Crowd Control Method" circulated among police officers in the early fall. The email was brief, linking to a YouTube video titled "Skunk: A 'Degrading Form of Abuse' or Safe, Nontoxic Alternative to Rubber Bullets?" The written text accompanying the link extolled the virtues of Skunk: "the Israeli biomedical engineers have done it again." Skunk is classified as a malodorant, nonlethal weapon, and it has been used by the Israel Defense Forces since 2008. While there is no proof that Skunk was used at Standing Rock, it is available in the United States and was purchased by the St. Louis Metropolitan Police Department after the Ferguson protests.¹¹ With substances like these, the atmosphere becomes not only a medium for violence and control, but also one through which affects intended to demean are engineered.

The atmosphere is increasingly a sphere to be weaponized. Peter Sloterdijk argues as much with his conception of *atmoteror*, in which the environment becomes a

coercive object of technological mediation. Sloterdijk emphasizes that humans "simply cannot not breathe," which is why atmospheric weapons are a profound form of terror(ism) that create atmospheres of apprehension.¹² To this end, it is Indigenous nations that disproportionately contend with the toxic legacies of late industrialism in the air.¹³ There are 532 Superfund sites on tribal lands, nearly one for each of the 562 federally recognized Indigenous nations in the United States. The settler-colonial project of U.S. Empire is, after all, to place Indigenous nations and bodies into suspension. Treating Indians as a crisis or colonial residue, regulating them, as Jodi Byrd argues, "to the site of already-doneness that begins to linger as unwelcomed guest to the future."¹⁴ suspends large-scale processes of capitalism, militarism, racism, and colonialism. We become excessive and need to be managed, or else we are ghostly traces that must be pushed aside.

Differently put, suspension is a condition of settler-colonialism—it suffuses all places, and keeps in play the contradictions and ambiguities built into the colonial project. This essay aligns itself with the larger political project of attuning to and staying with those contradictions and ambiguities.¹⁵ Audra Simpson describes the "strangled political order" of Indigenous nations, noting that "under the conditions of settler colonialism, multiple sovereignties cannot proliferate robustly or equally."¹⁶ Some of us simply cannot breathe.

Our attunement to settler atmospherics can perpetuate further injury.¹⁷ It can be pathologized as anxiety, paranoia, or conspiracy in an atmosphere of uncertainty and half-knowing. At Oceti Sakowin, too, we experienced various suspensions: of time, bodies, affects. Anticipation of state violence became a rhythm, with constant low-flying helicopters, floodlights, and a large militarized police presence creating a tension that settled deep into muscles. The forces of strangulation were viscerally felt at Oceti Sakowin camp as water protectors faced attack dogs, handcuffs, flex cuffs, stress positions, water cannons, fists, feet, assault rifles, arrest warrants, rural county jails, felonies, misdemeanors, private property, body armor, drones, private security, tear gas, mace, armored Humvees, the intentional defilement of gravesites, the North Dakota National Guard, the North Dakota State Patrol, Border Patrol riot shields, billy clubs, concrete barricades, airplanes, Blackhawk helicopters, Caterpillar earthmovers, and media censorship and harassment.¹⁸

Alongside the asphyxiation of "Indigenous governmental forms, philosophical practices, and gender roles,"¹⁹ I would argue that colonial governmentality necessarily strangulates other forms of relationality and coalition building. Key valences of this relational severing are toxic strangulations—social and chemical—that Indigenous nations and other marginalized com-

munities endure.²⁰ These materials are difficult to trace, require multiple forms of expertise to negotiate, and we have been trained to not see them.

For Timothy Choy and Jerry Zee, suspension is a method for orientation in an atmospheric problem-space.²¹ A life in suspension generates multiple openings and entryways into structural conditions, and allows for the challenging of our assumptions and disbeliefs: our common sense. In a settler-colonial state this questioning must come with an awareness of the pervasiveness of settlement in shaping ordinary life. Such a phase shift from existing forms of settler common-sense brings out displacements with different qualities: what can you willfully unsettle in relation with others?

Those in suspension arc toward one another—becoming-open in an atmosphere of violence. Porosity thus becomes a site of potential, exposure, and entanglement all at once, questioning the stability of our worlds, human and nonhuman. In a porous relationality—attuning to how others (cannot) breathe, our haptics are enhanced, and we develop capacities to feel one another otherwise. Choy reminds us of the Latin root of *conspire*, as a breathing together, declaring: "Breathers of the world, conspire!"²² We need to conspire to strategize logics of agitation, which displace and unsettle. Doing so calls us not to ignore difference, but to create alter-relations with one another. As Choy underscores elsewhere, "breathing together rarely means breathing the same."²³

What would it take for individuals to reconceptualize the embeddedness in which we all already are with and have the potential to be *for*—to stage the grounds for a collective reimagining, a conspiracy, an atmospheric otherwise? Or, in Stefano Harney and Fred Moten terms, "a mode of thinking with others separate from the thinking that the institution requires of you"?²⁴ While EMAC enabled massive police-state coalitions that most likely will continue, so too did massive #NoDAPL coalitions coalesce. Christina Sharpe argues that "the weather necessitates changeability and improvisation [...] it produces new ecologies."²⁵ To this end, on 2 September 2016, Black Lives Matter's national chapter released a statement in solidarity with water protectors at Standing Rock, avowing: "We are clear that there is no Black liberation without Indigenous sovereignty." New ecologies are forming for liberation in a settler atmosphere.

To *liberate*, in chemistry, is to release a gas or energy as a result of a reaction, or else to release from combination. Our liberations are entangled—they are not pipe dreams and never were.

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Decolonization, Divestment, Deluge: Museums in the Era of Climate Change

Camille-Mary Sharp

It's no secret that many of our beloved cultural institutions receive funding from some of the most environmentally destructive corporations in the world. Even Rockefeller and Carnegie, renowned patrons of arts and education in Canada and the U.S., made their riches from oil extraction. Scrolling through a museum's annual reports or strolling through its exhibitions, one is likely to come across the name or logo of an oil company, whether in the form of subtle tax-deductible donations or exclusive partnerships. Some local examples from the past year include support given to the Royal Ontario Museum from Barrick Gold, and to the National Gallery of Canada from Imperial Oil.

Recently, the behind-the-scenes relationships between institutions like museums and their corporate sponsors have become scrutinized by environmental and artist groups. In 2017, thousands of people signed a petition calling for the Canadian Museum of History in Ottawa to cut its ties with the Canadian Association of Petroleum Producers (CAPP), a powerful lobby group that promotes the rights of oil producers in the country—often by undermining environmental protections and Indigenous sovereignty in legal courts. Meanwhile, in Europe, activist (artist/activist) collectives like Fossil Free Culture and Art Not Oil have mounted interventions (often theatrical and/or visual performances involving oil-mimicking black paint) condemning oil sponsorship in places like the British Museum, the Louvre, and the Van Gogh Museum. While such protests seem to be accompanying the recent wave of oil divestment campaigns in municipalities, universities, and even countries across the world, the change in consciousness over the finances of cultural institutions is historically grounded in critical artistic and museum practices, and Indigenous activism.

Contemporary Canadian museum theory and practice have been significantly informed by critical moments like *The Spirit Sings*, a 1988 Shell-sponsored exhibition at the Glenbow Museum in Calgary. Produced in conjunction with the Winter Olympics, the exhibition featured hundreds of Indigenous artworks and artifacts from museums around the world, many of which had been collected during early European contact and had rarely been exhibited or made known to Indigenous people, schol-

ars, or curators. Contesting the exhibition because of its sponsorship by Shell—which had been drilling in Lubicon Cree territory since the 1970s—Lubicon Cree activists garnered significant support for their boycott of the Winter Olympics. Similarly critiqued by scholars and museum professionals for its lack of consultation with source communities and display of sacred objects, *The Spirit Sings* has since been deemed a reference point for the decolonization of museum practice in Canada.

More recently, this has been symbolized by the Truth and Reconciliation Commission (2015), with its 67th Call to Action recommending that museums promote decolonization through a reform of their policies and practices. The call followed numerous years of work by museum studies scholars and activists, who have recognized and documented the colonial histories of museums and promoted community collaboration and the unlearning of exclusionary museum epistemologies. In practice, this has meant creating repatriation policies for looted artifacts and human remains, sharing authority and access with the owners of such objects, and the creation of task forces on the relationship between museums and Indigenous communities. It has also meant coming to terms with difficult institutional histories. For example, in 2016 the Royal Ontario Museum apologized for its 1989 *Into the Heart of Africa* exhibition and has since been developing programming in an attempt to repair its relationship with the Black Canadian community.

Such efforts have grown in parallel with the “greening” of museums, or the rise of initiatives aimed at reducing museums’ carbon footprints and promoting climate-change awareness. However, theories and practices of decolonization and greening in museums have remained seemingly disconnected. For example, the Art Gallery of Ontario’s *Anthropocene*, a 2018 photographic and cinematic exhibition meant to shed light on humans’ impact on Earth, failed to recognize the role of colonialism and capitalism in causing climate change and made no mention of environmental racism. These decisions stand in contrast to deliberate efforts by the gallery to disrupt its settler gaze—among them, the renaming of the department of Indigenous and Canadian Art, and initiatives under-

taken by curator Wanda Nanibush, such as major exhibitions by Indigenous women artists Rebecca Belmore and Rita Letendre, as well as the 2018 global Indigenous gathering *aabaakwad* (*it clears after a storm*). Similarly, funding models like corporate sponsorship have remained relatively absent from discussions of decolonization, and while divestment campaigns have gained ground in Europe, partnerships with the oil industry remain common in Canadian institutions.

In their distinct ways, divestment and decolonization efforts have simultaneously heightened concern around the financing of museums. Oil sponsorship remains part of a conversation that raises countless productive questions. For example, what does it mean to receive public funding from a government with an ongoing history of colonial violence and erasure? How can identifying the roots of public funding help us to grapple with the entanglement of settler-colonialism and extractive industries? By recognizing that the infrastructure, government, and social norms of a nation are all related to the extraction and production of its staple resource, the systemic interconnectedness of these funding sources is revealed. Canada’s dependency on oil, as one of the world’s top-ten largest producers, enforces a political-economic climate that ensures the continuation of its extraction, and the many legal struggles in Canada and abroad make clear the crucial role that nations and multinational corporations play in challenging and limiting Indigenous rights. Just this past April, Washington D.C.’s American Museum of Natural History (AMNH) offered a stark reminder of the complicity of museums in colonial violence and environmental destruction by states and corporations: Jair Bolsonaro, Brazil’s anti-Indigenous and pro-mining president, was to be honoured as “Person of the Year” at a gala at the AMNH. However, following public outcry, the gala was relocated. Along with a handful of other success stories, this makes it clear that protesting the dubious partnerships of museums keeps them accountable and promotes divestment from climate change-inducing industries. Similarly, continuing to scrutinize the sponsorship practices of oil producers can shed light on the connections between cultural production and the politics of resource extraction.



Indigenous Womxn's Collective members Maria Hupfield and Regan de Loggans in a performance action at Whitney Museum, New York, 15 May 2019. They state: “We, as Indigenous womxn and femme nonbinary people, are making a stand against the continued violent oppression of brown bodies and communities. By not removing Warren Kanders from his position on the museum board, the Whitney is in allyship with white supremacy and genocidal settler colonialism. We are in opposition, as Native artists, curators, and community members, to the continued ‘profit over people’ mentality. Indigenous people and other people of color are violently under attack by Warren Kanders’ manufactured weapons of terrorism. You, the Whitney, is harboring a terrorist who profits from violence against brown bodies. You want our art, but not our people.”
COURTESY MARIA HUPFIELD.

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Twelve Months at Tottenham after Luke Howard

J.R. Carpenter

| January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|--|---|--|--|--|--|---|--|--|--|--|---|
| Mists make dangerous travel. The air loaded with freezing particles. Attached to fixed objects. A blade of grass. Some garden shrubs. Spreading tufts of crystals. Gigantic specimens of snow-white coral. An elegant fringe. The rime falls. Transparent. In heaps beneath the trees. | Frost. Followed by clear sky. East wind. Early evening. On placing a wet finger on an iron railing it adhered strongly. The handling of a shovel might have endangered the skin. Morning. Thermometers found rising. Dryness and stillness lessen the impression. Of cold. Brilliant sun. | Impediments presented to navigation. A succession of heavy gales. Forty sail of vessels lying in wait. For fair wind. A gentle breeze. Spring weather commences. The sun assumes a splendour to which the eye has long been unaccustomed. This change. From the beginning. Obvious to sense. | Wind from the east. Veered westward. Blowing a hard gale. On the south coast. Considerable rain. Meeting a spring tide occasioned an inundation. Vegetation made little progress. The swallows appeared. A few swallows. Swallows amid squalls. Of wind. | Dry here. Thunder about. Distant thunder. A splendid meteor. A large body of blue flame followed by a long train of sparks. At considerable altitude. Travelling with velocity. Indicating the quarter from which the wind approaches. By cold winds. The leafing of trees retarded. | The character of this period. On the whole. Ungenial. Cattle in a declining state. Blighting winds predominate. Corn suffering from want of rain. A shower of an hour's continuance. In consequence. Vegetation passes. From starved and backward. Toward considerable luxuriance. | Mist resting on the cliffs and on the high land. Toward evening subsides. Appears on the sea below. A body showing close to the horizon. On the high land. Above mentioned. Walking. Mist on the sea advancing. Spreading westward. Comes at length. Close under sandy cliff. | Emphatically wet. Excessive rains. The whole season a series of storms and inundations. Not meadows and villages alone. Portions of cities and large towns also lay long under water. Crops carried off by torrents. The vintage ruined by want of sun to ripen the fruit. | Depression. Distinguished by a splendid display. Northern lights. Appeared most remarkable. Waves of snow-white light. Rolling from thin cloud. Condensed mist. Matter invested with a luminous quality. Released from magnetism. The breath became visible. | Sea air. As such. Is not necessarily moister. In the middle of the day. Air blowing directly. Carrying an abundance of spray. A fine mist from the surf. Out of the mist evaporation proceeded rapidly. At other times a southerly wind. Coming along shore. Was yet so dry. | Gales from westward. Gales prevailed. From the coast. The whole west coast. After which. The wind changing northerly. The night boisterous. A fluctuating depression of eight days. It rained slates and tiles in the town and there was no standing on the beach. | Sharp depressions. Not marked by gales of violence. Only one noted. Stormy from the westward. A strong wind. A large amount of rain. Fifty hours without intermission. Spring tides high. Along the south coast. Subsequent rapid elevation attending the change. |

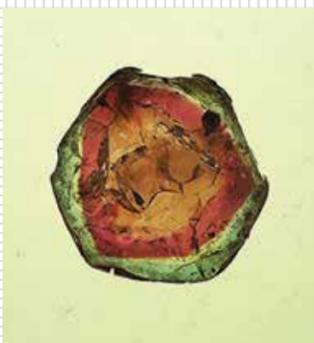
Supernatural Oracles

Since the dawn of human activity, we have been drawn to the latent energy that inhabits our earthly sphere. Whether we call them rocks, stones, gems or crystals, these substances offer Supernatural Oracles that tell us something about our connection to their apparently inorganic matter and the material vitality that lies within.

Natural Philosophy

Before modern science, Natural Philosophy as distinguished from metaphysics represented the philosophical study of nature and the physical universe, especially those beings and entities that undergo change. Here the term posits practices that bridge the study of nature and the nature of study where the speculative unity of nature and spirit remains mysterious.

A Rainbow Fragment



Tourmaline gets its name from the Sinhalese (Sri Lankan) word *tura mali* meaning stone of mixed colors. Legend tells us that tourmaline comes in many hues from indicolite (blues and blue-green), verdelite (greens), rubellite (reds and pinks), cat's eye (striped brown), paraiba (bright neon blue), schorl (black), dravite (yellows and browns) and watermelon (green and pink). The Ancient Egyptians believed that tourmaline travelled up or down a rainbow capturing its unique spectrum along the way. The pink version of this stone was highly desired by the last Empress of China, Empress Dowager Tzu (1861-1908). For centuries, the Chinese have carved this stone into intricately crafted snuffboxes and figurines. Tourmaline has piezoelectric qualities. When heated, bent or stressed it develops a static charge that attracts light-weight particles to its surface. As a result, it gains a positive charge at one end and a negative charge at the other (see Piezo electric Effect: Songs of Science). This might explain why African and Australian shamans have valued it for medicinal purposes (see Songs of Science: Mineral Medicine) as well as by alchemists who believed that it related to the philosopher's stone (see Natural Philosophy: The Philosopher's Stone) by reconciling opposites and changing base metals to gold.

Lapis Sacer



Veneration of stones by humans is part of the earliest forms of spirituality and kinship practices. Whether in response to their beauty, their shape, their material or their unusual markings, these natural forms have inspired worship and respect for millennia. Take for example the Lapis Nigrus, a shrine in the Ancient Roman Forum covered in black marble, the purpose of which is unclear. A more famous version is the Kaaba, an Islamic pilgrimage site located in Mecca whose cube structure is made of granite, marble and limestone. Inside the building in the eastern corner is the Black Stone, a Muslim relic believed to have fallen from the heavens as a guide for Adam and Eve to build an altar. Alternately described as a meteorite, basalt, agate and even glass, its actual composition is unknown. Another example is the Sacred Stone Camp in North Dakota on the Standing Rock Indian Reservation, which refers to the sacred stones for which the area was originally named. Here large, spherical stones were created by the confluence of currents where two rivers meet. Perhaps more respect than veneration, this last example suggests a relational understanding of and respect for matter, connection and kinship.

The Stone of the Northern Lights



Labradorite — also known as black moonstone — is a form of plagioclase feldspar found in the Canadian province of Newfoundland and Labrador as well as other parts of Canada, the United States, Mexico, South America, Finland and Norway. In Inuit lore, the stone is believed to have fallen from the frozen fire of the Aurora Borealis. In another version of the story, the Northern lights were trapped in the stone when a warrior pierced it with his spear and most of its spectrum was released into the sky. The colours that remained are what we know as labradorite, an optical phenomenon where light rays coming out of the stone are different than those that went in. This refraction of light as iridescent flashes of peacock blue, gold, pale green, or coppery red is known as labradorescence. Labradorite was deeply valued by the Beothuk peoples of Newfoundland and Labrador for its aesthetic and magical properties. It is now incorporated into jewellery, glass making, ceramics and road building. Composed of calcium, sodium, aluminum and silicate, this variety of feldspar occurs in igneous rocks and is most common in basalt.

Rock vs. Stone



Rock signifies a conglomerate of minerals as well as cultural and metaphysical objects. The term rock is itself a Gordian knot of geoscience, linguistics and anthropology. Take for example the distinction of rock vs. stone. A rock is a naturally occurring aggregate of minerals formed by geological processes. By contrast, a stone is a formation altered by humans whether as a tool, an architectural feature or an aesthetic form. A rock is not a stone. To further complicate things, rocks and stones can be confused with minerals, gems and crystals. The word mineral comes from the Latin *mineralis* or "obtained by mining" and refers to a naturally occurring solid substance with a specific chemical composition. Minerals are made of one or more elements that are arranged in a three dimensional pattern also known as a crystal structure. The habit or shape of a crystal is the outer manifestation of the repeating internal structure of its atoms. A rock is a material made up of two or more minerals classified as *igneous*, *metamorphic* or *sedimentary*. While rocks or stones are not necessarily a crystal, all three are composed of minerals.

Fossilized Ice



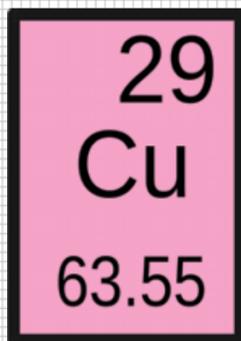
Twelve percent of minerals found in the earth's crust are quartz, a mineral composed of silicon dioxide and oxygen atoms. It is the second most abundant mineral in Earth's continental crust, behind feldspar. More than the popular transparent form, there are many types of quartz including agate, amethyst, citrine, jasper, tiger's eye, and onyx. These varieties were the most commonly used minerals whether in jewellery or hardstone carvings, especially in Asia and the Middle East. The Greeks thought that rock crystal quartz was fossilized ice, a belief that continued until the sixteenth century. An important mineral with profound technological applications, quartz is essential in the computer industry as it is used in silicon semiconductors (see Songs of Science: GeoTech). Quartz is believed to amplify subtle vibrations helping to focus, direct and store energy as well as facilitate the reception of information. The Greek word *crystallon* means frozen drop.

Poison = Antidote



Bezoar (*bezahar* in Medieval Latin, *bézoard* in Old French, *bāzahr* in Arabic, *bādzhahr* in Persian) means counter poison or antidote. In all instances, it is a gallstone from the stomach or intestines of animals, especially ruminants such as the Arabian deer or Asian porcupine. The stone is the reaction to indigestible material whether hair, straw or plant material such as cellulose. In India they are used as a tonic and sedative; when mixed with honey they are believed to bestow clear vision, literally and metaphorically. These stones were traded between the courts of Asia, the Middle East and Europe with their value often more than that of gold. Counterfeit versions contained toxic substances such as cinnabar and quicksilver. Introduced to Western medicine by Arabian doctors during the twelfth century, they were used as an antidote to arsenic, a common poison in European courts by embedding them in goblets as well as jewellery and amulets. As a medicine they were pulverized into a powdered form and taken with wine (see Songs of Science: Mineral Medicine). Their composition of calcium and phosphates acted as chelating agents neutralizing the effects of arsenic in particular. Bezoars are not actually minerals although they were included in an early Flemish text on mineralogy. Neither rocks nor stones, bezoars are nonetheless "natural" formations.

Sacred Copper



Copper has been a sacred metal for many civilizations. Initially its salts were used as a pigment for blue and green colours. For thousands of years copper has been smelted from ore, cast into molds and alloyed with tin to create bronze. Its name comes from the Latin *es cyprium* or metal of Cyprus where it was discovered early in the island's history. Ancient Egyptians, Filipinos, Greeks and Romans integrated it into jewellery while medieval Europeans cast coins with its malleable metal. Indigenous peoples throughout the Americas have revered copper as a sacred material using it for tools as well as ceremonial purposes and the distribution of wealth. The peoples of the Lake Superior/Upper Great Lakes region told stories about Mishipeshu, a fierce guardian who protected the sacred copper. Pacific Northwest traditional stories refer to Copper Woman, the first woman made by the Creator. In the modern era, copper has become fundamental to electrical and household goods as a conductor of heat and electricity. Perhaps less known are its antimicrobial properties and use in wood preservatives, doorknobs, faucets and other places likely to collect bacteria. And of course, copper is essential to all living organisms as a trace dietary mineral (see Songs of Science: Mineral Medicine).

Speaking in Tongues



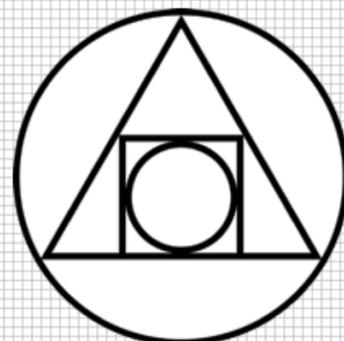
Chrysoprase — usually a translucent light green — is a variety of chalcedony, a form of silica composed of quartz and moganite. Its colour comes from the nickel oxide present in its composition. The word ending *prase* is a color-descriptor signalling its greenish hue, which comes from the Greek for leek. Indeed, it is the color rather than any pattern of markings that has made chrysoprase so desirable. Deposits of this form of quartz have been found in Russia, Eastern Europe, Brazil, Madagascar, Tanzania, South Africa, Australia and the USA. The Romans first identified it in 23 CE when the stone was believed to strengthen relationships and empower deep understanding. It was considered a magical stone that was re-charged at the half-moon by exposing it to the night sky. Some cultures believe that the properties of Chrysoprase allow the bearer to become invisible when a fragment is placed in the mouth. In Romanian folklore, it gives the power to access the language of lizards, who are believed to represent the soul's search for awareness and expansion.

Crystal Ball



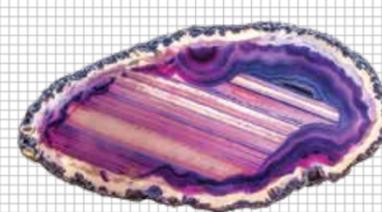
North and South American Indigenous peoples, Persians, Indians, Egyptians, Chinese, Celtic Druids and traveling Roma, first practiced gazing into a seer stone or crystal ball. In one Egyptian legend, the goddess Hathor carried a shield that could reflect back all things in their true light. The Shahnama, a Persian text from the late 10th century describes the pre-Islamic Cup of Jamshid used by wizards and practitioners for observing all the seven layers of the universe. Beryl was the preferred mineral for this kind of fortune-telling, a form of mediumship through communication with other realms. The practice is also known as scrying, which comes from the Old English word *descry* meaning "to make out dimly". The stone was often polished into a sphere to bring out its reflective properties. More generally, a transparent sphere of any material with refractive qualities can bring a focus near the surface. Staring deep into the ball's translucence is believed to induce a meditative trance, opening the unconscious to reveal secrets from multiple temporal directions.

The Philosopher's Stone



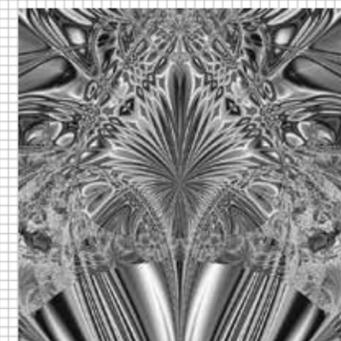
First described in Alexandrian, Chinese and Arabian texts and a central component of early scientific practices, the philosopher's stone — sometimes called *materia prima* — was an alchemical substance ground into a powder that could transform basic metals into gold. For the purposes of making gold the stone was a transparent ruby or saffron in colour, soluble in any liquid, yet incombustible in fire. The liquid elixir (*al iksir* in Arabic) derived from the powder was believed to cure illness and extend life in the form of a tincture (see Songs of Science: Mineral Medicine). The philosopher's stone, the most tangible and dense crystallization of a subtle substance, was also a metaphor for an inner transformation. Here the transmutation of metals, and the purification and rejuvenation of the body were seen to be manifestations of the same concept. The stone's vibrational energy was believed to reconfigure physical matter. It is called a stone, not because it is like a stone but for its concentration of subtle substances, a living mineral into a solid form.

The Writing of Stones



Roger Caillois, a literary surrealist and collector of minerals, believed in the sacred as a system that exceeded current understandings of reason and psychology. In his book *The Writing of Stones*, the surrealist poetically explores the syntax or language of stones, which possess a different relation to matter, a magical relation that creates patterns and coincidences across time and space through meaningful correspondences. He insisted on attending to the marvellous in science, pointing out that the newly discovered theories of the atom had collapsed all earlier thinking about nature. Caillois expands on how a stone might, "proclaim, or illustrate, more spectacularly than is usually the case, but at the same time in a manner almost obligatorily reticent and cryptic, the existence of fundamental constants which ensure the latent continuity of the tissue of the world. Then the object makes a sign, becomes sign. It attracts onto itself that exact imagination, which reveals the object more than inventing it." As magical forms of matter, stones tell us a story, reflecting back onto the viewer something of their own material and psychic nature.

The Crystal-Image



The fundamental operations of time all lie within the crystal. The Crystal-Image as described by philosopher Gilles Deleuze points to non-chronological time, those trajectories of time condensed in cinematic image-clusters but also works of art that compose and recombine both the past and the present simultaneously. Here the force or pressure of time is condensed either in a singular image or a circuit of images that begin to exchange one for the other destabilizing linear time or displacing it with psychological and prismatic folds of experience. At its core the Crystal-Image reflects back the logical contradiction that is temporal experience (see Songs of Science: Time Crystal). The Crystal-Image shapes time as a constant two-way mirror that splits the present in two directions. In film, the crystalline is evoked in the editing of irrational cuts from one image to the next or as a false continuity that interrupts the normative linkage between two sequences. These disjunctive cuts give us a vision of psychological time. The Crystal-Image points to an inherent indiscernibility oscillating between its scientific and supernatural energies as it vibrates between the geologic and the mystical.

See cover and p. 3

Randy Lee Cutler, An Elemental Typology

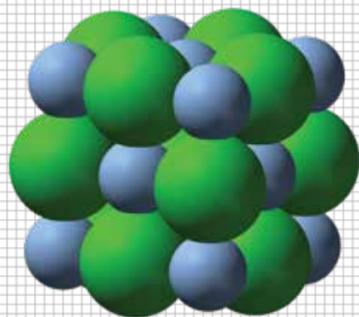
Songs of Science

In the scientific fields of medicine, chemistry, physics or geology, the vibrational energy and ordered particles of minerals, the earth's primordial elements, are harnessed to reveal the Songs of Science. Within their rational methods these practices contain poetic and visionary discoveries.

The Underworld

Beneath the earth's crust natural compounds are formed through geological processes. Rather than remaining in this underworld, these lustrous and potent formations are extracted and wrestled from vast gaping holes for industrial applications exposing the economical ballast and traumas that subtend all mining processes.

Mineral Medicine



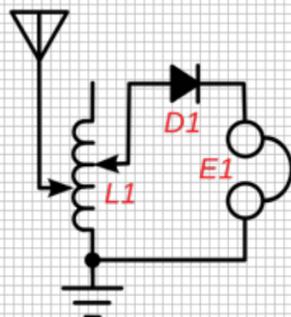
Minerals, essential nutrients in the human body, include calcium, potassium, sodium, magnesium, phosphorus and chloride as well as trace minerals such as iron, iodine, manganese, chromium, fluoride, copper, selenium and zinc. Minerals have been used as medicine and cosmetics in Ancient Egypt, Greece and Rome while Assyrian and Babylonian texts contain descriptions of their magico-medical powers. For example, Egyptian malachite, which contains copper was used for diseases of the abdomen and dental problems perhaps due its antimicrobial effects (see Supernatural Oracles: Sacred Copper). In Indian Ayurvedic medicine, various gems are believed to increase longevity (diamonds), cure fever (aquamarine) or heal skin diseases (topaz). In Chinese medicine, geological minerals including mud, clay and pulverized fossil remains help to restore an imbalance of energy. And Islamic medical texts suggest that fossils and gemstones were used in tonics to strengthen the inner organs. Based on real observations, most of these practices have been found to have both curative and magical properties.

Piezoelectric Effect



Jewel bearings were first used in watches in 1702 to reduce friction. A century and a half later in 1880 the piezoelectric phenomena (electricity resulting from pressure) was discovered when tourmaline, quartz and topaz were subjected to mechanical stress. The word piezoelectricity comes from the Greek *piezein*, meaning, "to squeeze." In 1927, quartz was introduced to time-keeping to regulate an electronic oscillator, making it even more accurate than mechanical clocks. When compressed or an electrical charge is applied, specific crystals can generate an electrical current called the piezoelectric effect. The frequency of this force, thousands of times per second, is in part a function of the cut and shape of the stone. Mechanisms that rely on piezoelectricity include inkjet printers, quartz watches, sonar technology, smoke detectors, autofocus cameras, pick ups in electric guitars, and monitors in medical ultrasound, to name but a few. Contact microphones use piezoelectricity to turn sound energy into electrical signals. And stylus or record player needles are made from a variety of materials including sapphires and diamonds also in order to generate a piezoelectric effect.

Crystal Radio



Mineral specimens as lively objects inform the relationship of crystals and radio signals. In one form, a crystal radio receiver, sometimes referred to as cat's whisker receiver (patented 1901), operates through radio waves via a wire antenna. The crystal component made from the mineral galena or pyrite offers up its capacity for natural frequencies and vibrations although the signal is quite weak. The other type of crystal radio requires an outside power source to harness the energy within the mineral. Building on this technology the mineral germanium, which is chemically similar to silicon, can act as a semi-conductor in transistors and other electronic devices. Currently, these crystal diodes are used in radar as well as the semi-conductors found in computers. Modern crystal radio sets can contain both a crystal oscillator and piezoelectric crystal earpieces (see Songs of Science: Piezoelectric Effect).

Extraction



Mining extraction from the Earth, usually derived from ore, lode, vein, seam and reef deposits, removes valuable geological materials including metals, coal, oil shale, gemstones, limestone, chalk, rock salt, potash, gravel, and clay as well as petroleum, natural gas and even water. Two types of operations represent current practices; large industrial mines and small-scale, informal digging sites. Often the labour practices for these large sites are deplorable with poor adherence to health and safety guidelines. The majority of gemstones and mineral specimens are harvested as a by-product of large scale mining activities (ore, coal, copper, aluminum, gold, etc.), by accident or "hand" mining. Extraction operations create a negative environmental impact, both during the mining activity and after the mine has closed. Most of the global trade in these materials are generated through the industrial mines that contribute to soil contamination, erosion and sinkholes, the loss of biodiversity as well as ground water and air pollution. Assessment of these activities depends on what we understand as damage to the Earth, to animals, microorganism and biodiversity in general.

A Forest of Selenite



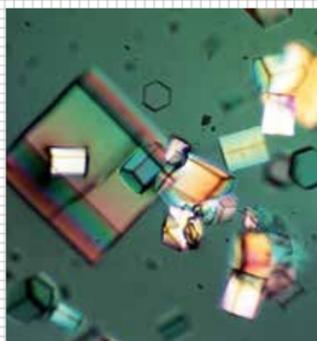
A mine located in Naica, Saucillo in the Mexican state of Chihuahua has forged crystals of selenite that are as large as trees, one metre in diameter and fifteen metres long. Hydrothermal fluids emanating from the magma chambers below formed these extraordinary entities. Originally, the macro crystals developed underwater in the area where sulphide saturated phreatic thermal waters came in contact with oxygen-rich cold waters, naturally infiltrating from the exterior. These singular conditions provided the habitat that gave rise to this forest of massive selenite formations. Three hundred metres below the surface, the cavern's temperature is 58°C with 99 1/6 humidity, an inhospitable atmosphere for most organic life although a recent speleological study resulted in the recuperation of pollen and microbes inside a selenite crystal. The first of the Naica caves were discovered in 1910 and almost 100 years later, another three caverns were unearthed at a different level. Other important mineral caves are in Lechuguilla, New Mexico; the Liquid Glass Digs, Israel; Santana Cavern, Brazil; Alum Caves, Island Vulcano, Sicily; and Kap-Kutan among others in Turkmenistan.

Earth Mirror



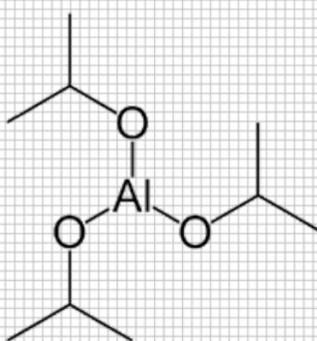
At 3,600 metres above sea level, Salar de Uyuni, located near the crest of the Andes in Bolivia, is the world's largest salt flat. These 10,582 square kilometers developed over thousands of years transforming several prehistoric lakes into a natural wonder. During summer months, it is a source of salt as well as more than half the world's supply of lithium, which is used in batteries for mobile phones, computers and electric cars (see Songs of Science: GeoTech). Lithium, from the Greek for stone, is a soft, silver-white metal: 50 to 70% is commonly obtained from brines and clays. In November, Salar de Uyuni becomes the breeding ground for three South American flamingo species that feast on the microbes attracted by mineral and potassium deposits that crust the shallow salt lake. During the flooding season, the rains transform the flats into a shallow pool with a smooth surface creating the world's largest mirror. Due to the absence of industry and its high elevation, the skies above the salt flats are very clear. To calibrate their satellites' remote sensing instruments, several governments take advantage of this seasonal phenomenon, as the surface reflectivity for ultraviolet lights is particularly powerful.

Crystallography



Crystallography determines the atomic and molecular structure of a crystal. The method is important in understanding atoms, their chemical bonds as well as the three-dimensional structures of biomolecules. The arrangement of atoms determines the characteristics of a given material as well as chemical interactions and processes. Crystallographers study a diverse array of substances from living cells and superconductors to diamonds, viruses, gases and DNA. Chemist Rosalind Franklin used crystallography in her discovery of the double helix structure of DNA (1951-53). Working in such disciplines as chemistry, geology, biology, materials science, metallurgy and physics, crystallographers use conventional (x-rays) and emergent technologies including atomic force microscopy, neutron diffraction, electron crystallography, molecular modeling, high-and low-temperature studies, high-pressure diffraction and micro-gravity experiments in space. The United Nations recognised the importance of the science of crystallography by proclaiming 2014 the International Year of Crystallography.

GeoTech



Lepidolite is a source of lithium (see The Underworld: Earth Mirror), which powers consumer grade batteries. There are miles of copper pipes and wiring inside our homes. Kyanite is sometimes utilized in the manufacture of spark plugs in cars. Airplanes are made from aluminum and titanium. Carbon is added to iron to make stainless steel products. Graphite is used in pencils and in motor oils. Nickel is used in coins. The minerals in most computers, tablets and cellphone include gold, tin, tungsten and tantalum (see The Underworld: Conflict Minerals). And silicon — one of the most abundant minerals in the universe — is a major component in computer processors (1961). More recently, quartz, a common mineral on Earth has been proposed as the future of data storage (2016). Mobilizing the five-dimensionality of the crystal, which is the usual three dimensions plus polarization and intensity, each two-centimetre square and two-millimeter thick slice, containing three layers of information etched through pulses of light, can be read with an optical microscope. Waterproof and resistant to alteration, these objects (the size of a fingertip) can store 360 terabytes of information with no degradation of information.

Time Crystal



The stuff of science fiction, crystals behave differently than other forms of matter. Time Crystals, according to a recently proven theory that breaks the second law of thermodynamics, have an atomic structure that repeats not just in space but also in time. (Proposed 2012, observed 2017) Whereas normal crystals can be asymmetrical in space, Time Crystals are asymmetrical in time, extending the ordinary three-dimensional crystal symmetry to include the fourth dimension of time. A fracture in time's symmetry allows these substances to stay in perpetual motion. As Time Crystals oscillate in their ground state, matter and structure are created by a time loop that repeats itself. What this means is that they move without energy. This new form of quantum matter is radically changing our understanding of the space-time continuum and the theory of time in general, allowing scientists to explore new frontiers in quantum computing and other forms of future technology (see Songs of Science: GeoTech).

Conflict Minerals



The term "blood diamonds" highlights the violent diamond trade in war zones (Angola, Congo and Sierra Leone), which finance militias. Conflict minerals refer to the products derived from similar activities involving other natural resources. The four most commonly mined conflict minerals most of which are extracted from the Congo are cassiterite (for tin), wolframite (for tungsten), coltan (for tantalum), and gold ore (see Songs of Science: GeoTech). In addition to feeding global jewellery companies, conflict minerals are also used in the manufacture of a variety of electronic devices such as mobile phones, laptops, etc. Miners are usually "hired" at gunpoint and working conditions are extreme, frequently leading to death. Insurgents use tactics such as rape and other forms of violence to control the local population and destroy the social fabric. It is often difficult to trace these conflict minerals as they pass through the hands of numerous middlemen by way of neighbouring countries such as Angola, Burundi, Central African Republic, Democratic Republic of Congo, Rwanda, Sudan, Tanzania, Uganda, and Zambia. Governments are attempting to legislate due diligence with regard to tracing the supply chain. On a smaller scale, many businesses and institutions are demanding that conflict free minerals are used in their electronic devices heralding perhaps a new direction in industrial mining.

Over the Coals



Coal, a combustible sedimentary rock, is the largest source of energy unearthed from a dense and primordial underworld, and with it carbon dioxide on planet Earth. Formed from the decomposition of plant life, Earth's excrement, it is not generally classified as a mineral. It is composed primarily of carbon with trace amounts of hydrogen, oxygen, nitrogen and the mineral sulphur. There are five types of coal including anthracite, bituminous, graphite, lignite and peat. Coal is mainly found in mines. Until the eighteenth century this dark rock was burned exclusively for its carbon dense energy. Through the destructive distillation of bituminous coal, a thick black liquid called coal tar is produced containing benzene, naphthalene, phenols, aniline, and many other organic chemicals. Since the 1800s, coal tar was used for medicinal purposes as well as in the pharmaceutical industry. In 1853, an English chemist working with coal tar, accidentally discovered the first synthetic dye coloured purple and called it mauveine. This led the way to dozens of other shades, all made with aniline dye from coal tar. Other coal tar by-products include benzene (perfume-making), creosote (cough syrup and the preservation of wood), naphtha (spot remover), paraffin, (candles) and toluene (saccharin).

Burning Vision



In 1789 uranium, a silvery-white metal named after the newly discovered planet Uranus was identified in the mineral pitchblende. For 150 years, it was used as a colouring agent in pottery and glass. Past forward to WWII when the Canadian Eldorado Gold Mining Company, located near the eastern shore of Great Bear Lake, extracted uranium-bearing ore in order to supply the U.S. military with the uranium needed to produce the nuclear bombs that devastated Hiroshima and Nagasaki. Great Bear Lake is located on Sahtu Dene territory in the northern boreal and Arctic region. In the late nineteenth century, a Dene seer had a vision of men going into the ground and walking out with something that would rain fire down on other people. In the 1940s Dene miners were told that they were digging for a substance to cure cancer. By the 1960s, the miners who had hauled bags of the stone out of the ground began to die of lung cancer and other lung diseases. Pre WWI, female factory workers in the United States also contracted radiation poisoning from painting watch dials with self-luminous paint containing radium (the radium compound is found in uranium) when they wetted their paintbrushes with their mouths to keep them sharp. Marie Clements writes about this little-known history in her play *Burning Vision*, 2003.

Aviation and Climate Change

Laurel Besco

In just over a century, flying has gone from being a remarkable achievement to something done by only the elite to a commonplace form of transportation for travelers and goods. This change and subsequent growth in flying has been largely spurred by technological innovation, as aircraft evolved from the first prototypes to propeller planes and finally to jet planes capable of flying more than halfway around the world without stopping. At the same time, economies have grown, people have more disposable income, the price of flights has come down, and the desire to travel (for leisure, business, or to visit friends and family) has increased. Now, each day, millions of people travel by air,¹ and 657 million packages are transported by plane.²

Over a similar timeframe, the world has begun to realize the impact that humanity is having on the environment, and the seriousness of climate change. Since the landmark *Paris Agreement* was signed in 2015, there has been a renewed urgency for action to reduce greenhouse gas (GHG) emissions across all sectors of the economy and in all countries of the world. Somewhat surprisingly, the aviation sector has not been well recognized in these plans for emissions reductions, despite the fact it is a large and growing source of emissions, currently representing two percent of global GHG emissions,³ (more than the entire Canadian contribution). While emissions from domestic flights—those which depart and arrive in the same country—are reported as part of annual emissions accounts, international emissions are reported separately and not tied to any one country. Who is responsible? Which laws apply? This uncertainty in who must account for and reduce international aviation emissions is largely tied to the complexity of a sector that crosses jurisdictional boundaries thousands of times a day.

The standard proposals for how to reduce GHG emissions from aviation have included sustainable fuels, technological improvements, operational improvements, and the use of market-based measures.⁴ There is still great interest in biofuel innovation, technological changes, and operational shifts, but the most recent advancement has been that the international community developed and implemented their own market-based measure, a program named the *Carbon Offsetting and Reduction Scheme for International Aviation* (CORSIA).⁵ While an important step forward, there

are significant questions about the long-term impact of this mechanism on absolute and lasting emission reductions from the sector. The stated goal of CORSIA is carbon-neutral growth beyond 2020, which effectively means the industry could continue to operate and grow exactly as they are so long as they purchase offsets (emission reductions from another source) that are equivalent to what they produce in their flights. Therefore, while this mechanism is a step in the right direction, the challenge remains of how to mitigate emissions in a way which results in absolute reductions from international travel. Further, CORSIA, as its name suggests, only deals with international flights, leaving emissions from domestic flights outside of its scope. This has potentially significant impacts on emission growth, especially in large countries like Canada where a domestic flight might produce more emissions than an international flight in Europe or Asia. While CORSIA has approached the issue of the international nature of emissions in a sensible way—countries are responsible for reporting on how their airlines have offset emissions—the mechanism itself is likely to struggle in moving the sector towards decarbonization unless innovative approaches to offsetting programs are undertaken and clear linkages to domestic policies are made. It is going to take meaningful changes in behaviour, technology, or aircraft fuel (and likely a combination of all three) for real progress to be made in mitigating the impact of aviation on the global climate.

1 International Aviation and transportation Association, "Growth and Development," <https://www.iata.org/about/Pages/history-growth-and-development.aspx>.

2 International Aviation and Transportation Association, "The Value of Air Cargo: Air Cargo Makes it Happen," <https://www.iata.org/whatwedo/cargo/sustainability/Documents/air-cargo-brochure.pdf>.

3 Ipek Gençsü and Miyuki Hino, "Raising Ambition to Reduce International Aviation and Maritime Emissions," *The New Climate Economy* (2015): https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/NCE-Aviation-Maritime_final.pdf.

4 International Civil Aviation Organization, "On Board: A Sustainable Future," ICAO Environmental Report 2016, <https://www.icao.int/environmental-protection/Documents/ICAO%20Environmental%20Report%202016.pdf>.

5 ICAO, "Carbon Offsetting and Reduction Scheme from International Aviation (CORSIA)," <https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx>.

Ontario's Energy Grid and the Ontario Clean Air Alliance

Kristen Schaper

Ontario's power supply is split between a variety of sources, including solar, wind, biofuel, gas, and hydro power. Each of these sources are greatly outweighed by the province's nuclear energy supply, which meets 60% of Ontario's energy demands.¹ While renewable energy is establishing itself as a viable alternative, Ontario is still reliant on the aging nuclear power system, which according to the Ontario Clean Air Alliance, is no longer seen as an innovative alternative to coal power. In fact, the key element in this energy system is very costly, as many of Ontario's nuclear power plants need updating through the replacement of nuclear reactors. Accordingly, the decision to further invest in nuclear power plants is a pressing issue for the Government of Ontario.

The Ontario Clean Air Alliance (OCAA), is a not-for-profit organization that has campaigned for a 100% renewable energy grid since 1997. The OCAA was instrumental in the successful push to phase out coal power in Ontario, making this action the world's first large-scale phase out of coal power. In 2003, Ontario made a commitment to closing its five coal power facilities, starting with Mississauga's Lakeview Generating Station, which officially ceased operations in 2005.² This decision led to a drastic decrease of smog advisory days in the GTA, which were at a record high in 2005 with 15 advisories covering a total of 53 days. Compare to 2018, where Ontario experienced only two special air quality statements and no smog and air health advisories.³

In another successful campaign, the OCAA was instrumental in advocating for the conservation of power as a cost-effective alternative and helped to reduce the energy demand in the province by 18%. Since this campaign, the OCAA has turned its focus towards the shift from nuclear energy to buying surplus hydroelectric power from the neighbouring province of Quebec. By obtaining data directly from the Independent Electricity System Operator, Hydro Quebec, and Ontario Power Generation⁴ the OCAA has as compiled research demonstrating that as an alternative to nuclear energy, hydro power would lower the price of electricity for the province, steering Ontario toward a more environmentally-friendly energy future.

An OCAA report suggests that the Ontario Government's proposals to reduce

spending on a variety of programs could be avoided by buying low-cost water power from Quebec.⁵ The OCAA suggests that this decision would cut \$1.8 billion from the Ontario Government's deficit. This makes for an easy alternative, but not without some hiccups. Phasing out nuclear power in Ontario would mean a loss of jobs at nuclear power plants and a reliance on obtaining power from Quebec. However, these implications could also have an opposite effect as the removal of nuclear power plants (and the corresponding jobs) would open more room for careers in the green energy sector. While Ontario has previously been successful in buying hydro power from Quebec through small contracts, a larger contract would necessitate Quebec's construction of additional dams. Along with the construction of new dams comes environmental and ecological destruction as well as danger for those working on site. For example, in 2017, construction of the Romaine dam was halted when four workers lost their lives.⁶

The OCAA has released a report comparing all of Ontario's electricity options.⁴ At over four times the cost of buying Quebec's water power, nuclear energy is the most expensive alternative and this option will almost double in cost by the year 2025. Keeping energy supply within Ontario and switching to wind power, the best alternative, would only save Ontarians 0.2 cents per kWh. With the OCAA's well-researched cost comparison, it begs the question: why does nuclear power persist as the default option? This may be due to the path-dependency of energy systems where governments invest in large energy projects, such as a nuclear power site and consequently lock their economies into this investment without fully considering the long-term impacts of this decision.⁷ In the case of nuclear power, long-term effects include the storage and safety measures required to manage nuclear waste, which continues to be a concern to public and environmental safety.⁸

To keep up the momentum of the OCAA's voice within the energy industry after the phase out of coal power in Ontario, the organization publishes studies, bulletins, newsletters, and petitions on their website. Their most recent petition asks the Ontario Government to lower electricity bills in the province through a deal with Quebec.⁹ In addition to their existing strat-

egies, the next step for the OCAA is to advocate for the Pact for a Green New Deal, a national initiative working toward a 100% renewable energy system across Canada. The Green New Deal will emphasize pushing the Government of Canada to divest from fossil fuels and move toward a future of renewable energy. With its existing successes whose net effect have been cleaner air in the province, the OCAA is sure to be an important player in the challenges that lie ahead in the movement for sustainable energy generation.

1 Nuclear Power. May 2019. <https://www.opg.com/powering-ontario/our-generation/nuclear/>.

2 The End of Coal. December 2017. <https://www.ontario.ca/page/end-coal>.

3 Summary of Special Air Quality Statements and Smog and Air Health Advisories 2015 to 2019. http://www.airqualityontario.com/aqh/advisories_stats.php.

4 Ontario's Electricity Options: A Cost Comparison. January 2019. <http://www.cleanairalliance.org/wp-content/uploads/2019/01/options-2019-1.pdf>.

5 The 2019 Ontario Budget: Does it really protect what matters most? May 2019. <http://www.cleanairalliance.org/wp-content/uploads/2019/05/ontario-budget.pdf>.

6 In Quebec, Canada's newest hydroelectric dams nearly ready. November 2018. <https://phys.org/news/2018-11-quebec-canada-hydroelectric-ready.html>.

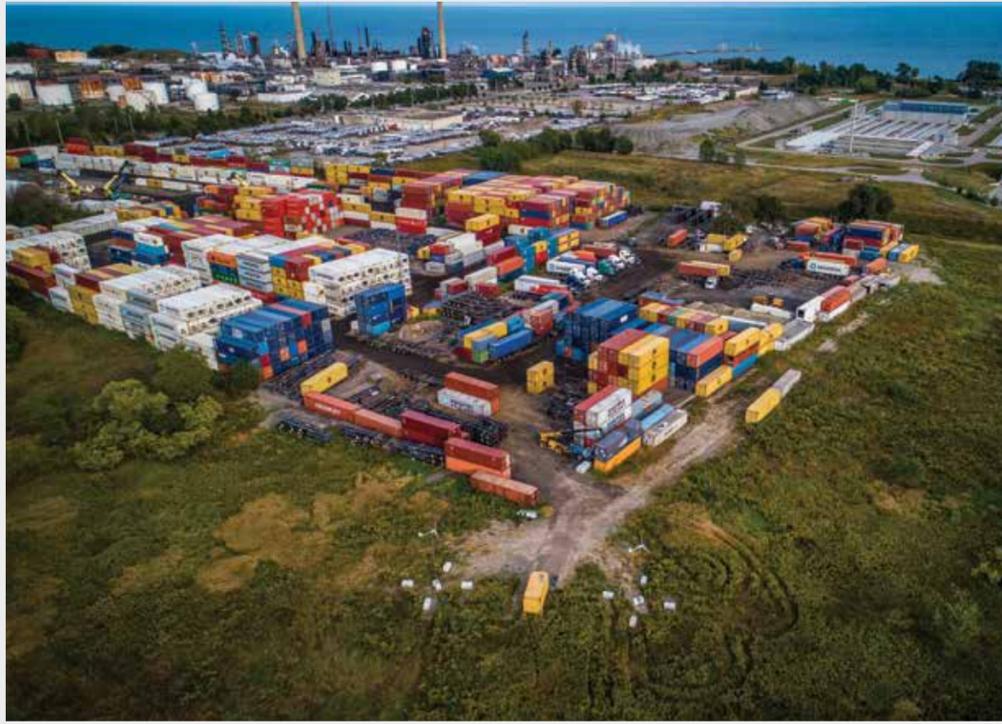
7 Fouquet, Roger, *Path dependence in energy systems and economic development* (London, United Kingdom: LSE Research Online, 2016), p. 16098. http://eprints.lse.ac.uk/67119/1/Fouquet_Path%20dependence_2016.pdf.

8 Pickering's big and growing waste problem. June 2018. <http://www.cleanairalliance.org/pickerings-big-and-growing-waste-problem/>.

9 Buy low-cost water power from our neighbours in Quebec. <http://www.cleanairalliance.org/cut-my-bill/>.

Implementing Environmental Efficiency in Freight Trucking: Musket Transport

Operating in Mississauga for over twenty-five years, Musket Transport is a transportation and logistics company specializing in intermodal container transportation. With four locations across Mississauga, Musket provides broad-scale trucking throughout Southern Ontario, Quebec, and the northeast United States, as well as a specialized driver training program. With their notable boost in environmental initiatives since 2016, Musket continues to grow its business while upholding a corporate social responsibility mandate. Within the transportation sector, Musket's green initiatives are aimed both at responsible business practices and the inherent cost-savings of fuel efficiency in their day-to-day operations.



Climate Audits

In 2018, several Musket Transport employees took part in Climate Smart, a certification program offered through the Mississauga Board of Trade. Climate Smart is a BC-based company that empowers companies to lower their greenhouse gas (GHG) emissions through broad and comprehensive audits focusing on energy efficiency, fuel consumption, and waste management. Through Climate Smart, Musket staff implemented technological tools enabling them to quantify and track the company's overall GHG emissions. Setting 2016 as a baseline figure, Musket tracks its annual progress toward greater energy efficiency.

Musket Transport staff have also worked with Credit Valley Conservation, participating in the latter's Greening Corporate Grounds program to consult on how to make their facilities more environmentally-friendly. Despite the challenges of greening a container yard, Musket is mitigating dust by paving its facilities, engaging employees in tree-planting programs, and looking to implement green roofs in select areas.



Transportation Sector

Trucking companies face unique challenges when considering ways of reducing their environmental impacts. The transportation sector amounted to just under a quarter of Canada's greenhouse gas emissions in 2017, of which freight trucks represent the largest share of all modal types, representing approximately one-third of total transportation emissions.¹ As a cost often overlooked in the retail price of goods, transportation providers are challenged by the persistent drive for lower prices. As such, the freight transportation industry is structured on single-digit profit margins, a fact which poses challenges to companies' abilities to invest in energy and fuel efficiency.²

Greener Fleets

Lean profit margins in freight trucking are a major barrier to mitigating pollution. To reduce tailpipe emissions, trucking companies are primarily reliant on truck manufacturers' technological innovations, which improve fuel efficiency and aerodynamics. Such innovations are ongoing, but necessitate significant investment from trucking companies to implement greener fleets. For a mid-size company like Musket Transport, such investments can be a strain on financial resources. With its recent purchase of 160 Volvo VNL 740's—one of the most fuel-efficient trucks on the market—Musket has demonstrated their commitment to reducing tailpipe emissions.



Driver Training

Beyond its core business, Musket Transport operates Commercial Heavy Equipment Training Limited (CHET), a driver training school from which Musket hires 80% of all graduates. Corporate Communications Officer Sophia Sniegowski notes that CHET was founded in response to the barriers to employment for would-be drivers. For one, CHET provides hands-on driving experience that bolsters drivers' capabilities to secure the necessary insurance coverage for employment. In addition, the training program provides nearly double the driving hours mandated by the Ontario Ministry of Transportation, thereby ensuring that drivers are well-prepared for a wide range of issues they might face on the road.

Driver Engagement

Sniegowski notes that truck drivers take great pride in their vehicles, which serve both as a workplace and a "second home." Musket Transport validates drivers' attachment to their vehicles by rewarding fuel-efficient drivers with unique decals. Musket also fosters fuel-efficient driving habits from the beginning as part of its CHET program. By incentivizing fuel efficiency and tracking progress using dashboard data, Musket's driver engagement strategies recognize drivers as crucial to an environmentally conscious business model.

Repair and Reuse

Musket's facilities include comprehensive repair and reuse areas for vehicles and equipment. Given their focus on intermodal shipping containers, opportunities for reuse and adaptation are open to the myriad creative ways containers are used. Once no longer viable for trucking, Musket's containers are often repurposed—from the occasional sale to an individual buyer, to Musket's own reuse of containers as temporary offices during periods of expansion and growth.



Structuring Green Initiatives

Musket Transport's business is growing, and employee turnover rates are at a mere 1%. Between their CHET driver training and low turnover, Musket has little need for driver recruitment marketing. As such, they focus on other forms of community partnerships and engagement, as in sponsorship of *The Work of Wind: Air, Land, Sea*. During the 10-day contemporary art festival, artist Julian Oliver's project *HARVEST* was sited at Musket's location: at the back of the container yard, two 2-kilowatt wind turbines powered a cryptocurrency mining computer, which generated funds to be subsequently donated to support climate change research. At the front of Musket's facility, visitors could see live data and video from the mining process projected inside a shipping container.

Musket's support for the Blackwood's programming will continue in early September 2019, with the trans-border shipment of Gediminas and Nomedas' artwork *Futurity Island* to MIT in Cambridge, Massachusetts. First commissioned for *The Work of Wind: Air, Land, Sea*, *Futurity Island* will return to the home campus of both architects via a high-efficiency Volvo truck, and its exhibition will be activated by a series of public programs.

¹ Interview with Sophia Sniegowski Begidzhanov, Corporate Communications Officer, May 24, 2019.

² "Greenhouse Gas Emissions by Economic Sector," Natural Resources Canada, <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html#transportation>.

What is a Price?

D.T. Cochrane

“Oil prices are falling because fears of a glut in supply are growing.” – *Barrons*, 22 May 2019

“Oil prices fall despite tighter global supply.” – *Irish Independent*, 21 March 2019

This pair of headlines exemplifies a common, if puzzling, price narrative that validates mainstream economic theory.¹

The marginalist economic model tells us that when the supply of a product increases, the price of the product will decrease. This idea informs the first headline: oil prices are falling *because* oil supplies are increasing. However, prices frequently move in ways that defy the theory. But the headlines still validate it by expressing consternation at this improper behaviour, as in the second headline: oil price are falling *despite* oil supply also falling. This oscillation occurs because marginalist theory grossly over-simplifies the complex reality of price-formation.

Marginalist theory explains prices as the outcome of the famous “law of supply and demand.” This can be visualized with two lines on a graph that describe distinct relationships between price and quantity. If price rises, the quantity demanded falls (plotted as the downward-sloping demand curve). And, as price rises, the quantity supplied also rises (hence the upward-sloping supply curve). At the intersection of supply and demand we find the equilibrium combination of price and quantity: the “market clearing” price.

This relationship makes much intuitive sense, as we can see it operate in our own behaviours. Economists have leveraged this intuition to build a theory that substitutes the simple aggregation of individuals for the emergent complexities of society. But at the level of a society, the relationship between price and quantity, between supply and demand, is orders of magnitude more complex than is captured by the supposed “law of supply and demand.” In place of the mechanical equilibrating process (discussed in the column “What is The Market?”, *SDUK 02*), we must understand prices as constructions that temporarily—and incompletely—resolve and obfuscate myriad diverse social relations. Oil prices crystalize everything from American car culture to Middle Eastern politics.² These vastly exceed and defy the supply and demand functions of the marginalist model. The contradiction between the simplicity of the model and the complexity of reality explains the incongruous *because/despite* narrative.

One consequence of marginalist theory dominance within economics is a neglect for research and analysis on actual price-formation processes. Why is a barrel of oil \$59.14USD as of 28 May 2019? Why did it hit an all-time high of \$147.27USD on 11 July 2008? The complex array of entangled entities involved in—affecting and affected by—oil markets include the Saudi royal family, environmental regulations, Wall Street speculators, U.S. foreign policy, solar panel efficiency, Canadian pipeline capacity, fracking technologies, urban development, biofuel subsidies, oil industry unionization, on and on and on. All of the nuances and interconnections disappear into the over-simplifying law of supply and demand.

Karl Marx offered an alternative explanation for prices: labour. Supply and demand caused exchange value, i.e. prices, to fluctuate around their core determinant, value, which in Marx’s construction was ultimately determined by socially necessary abstract labour. The problems with Marx’s labour theory of value are well documented.³ One result of Marx’s reduction of price to labour value is that his adherents also largely have abdicated study of actual prices. Why is a share of Amazon \$1,836.43USD (28 May 2019), making the value of the entire company \$904.1 billion? Why is a subscription to Amazon Prime in Canada \$7.99CAD/month? Why is a subscription to Amazon Prime in the United States 12.99USD/month? Why is one Canadian dollar currently priced at 74 cents in American money?

There are people who try to understand these specific prices; many people, in fact. Currency traders, for example, need to understand the complex array of forces that push currencies up and down in order to make profitable trades. However, they focus their understanding without the kind of social and historical perspective that a social science like economics ought to offer an analysis. Further, these instrumental understandings do not question the fundamental mechanism of price.

The failure of both mainstream and critical political economy to centre the price-formation process is consequential. Price is the world’s most universal language: from a bushel of wheat, to a Picasso painting, to an hour of plumbing service, to a parcel of land in Brazil, to the disposal of an old television... almost every part of our social order is, or has been, priced. Those prices emerge from the complex web of social relations and have wide-ranging effects. Housing prices in Toronto

are making life in the city unaffordable for many people. The price of Amazon shares has made Jeff Bezos incredibly wealthy and powerful. The lack of a price on carbon emissions is implicated in the climate crisis.

I want to suggest an alternative basis for developing a critical perspective on price, derived from Marx’s critique of Aristotle. In the course of introducing his labour theory of value, Marx takes on Aristotle, approving of the Greek thinker’s early acknowledgement of value. However, Marx argues, Aristotle failed to develop a true understanding by primarily conceived prices as merely “makeshift for practical purposes.” This quote comes directly from Volume 1 of *Capital* and is offered by Marx as, according to historians, a highly idiosyncratic translation of Aristotle.⁴ However, what matters is not the accuracy of the translation or Marx’s critique, but rather the inadvertent insight it contains.

In essence, Marx’s Aristototle suggests that prices are not determined, they are constructed. And with this insight every part of the value-price matrix can be disassembled and queried. What are prices made of? What are the practices involved? What are the purposes and motivations? Only by examining the complex network of relationships that coalesce in a given price can we understand where it comes from and what its function is. And only then we can develop conceptual frameworks and analytical tools to further our understanding of prices as social objects.

Part five of a serial column on the fundamental concepts of commerce and exchange as driving forces that propel climate change.

Issue 01: What is the Economy?
Issue 02: What is the Market?
Issue 03: What is Growth?
Issue 04: What is Innovation?
Issue 05: What is a Price?
Issue 06: What is Value?

- 1 Hat tip to Professor Jonathan Nitzan for first making me aware of this narrative.
- 2 See, among many others on the political economy of oil prices, Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (London: Verso, 2011); James Marriott and Mika Minio-Paluello, *The Oil Road: Journeys from the Caspian Sea to the City of London* (London: Verso, 2012); Ken Silverstein, *The Secret World of Oil* (London: Verso, 2014).
- 3 See chapter 5 of Jonathan Nitzan and Shimshon Bichler, *Capital as Power: A Study of Order and Creorder* (London: Routledge, 2009) for an overview of those criticisms. Also see Cornelius Castoriadis, “Value, Equality, Justice, Politics: From Marx to Aristotle and from Aristotle to Ourselves,” in *Crossroads in the Labyrinth* (Cambridge, MA: The MIT Press, 1984) for a critique of the very concept of labour value as theorized by Marx.
- 4 See Ricardo F. Crespo, *Philosophy of the Economy: An Aristotelian Approach* (Springer, 2013).

Dust Management

Fraser McCallum

The idea that environments are circular loops of production and consumption has been central to recent and ongoing aspirations toward restoring and maintaining ecological balance. In the 1960s and 70s, scientists James Lovelock and Lynn Margulis put forth an influential theory of homeostasis, which characterized the Earth as a complex system that maintains balance through interdependent inputs and outputs of energy.¹ Termed the Gaia hypothesis, their theory asserts that Gaia (a name for the earth with origins in Greek mythology) has upheld its conditions of stability and habitability due to the coevolution and self-regulation of environments and organisms throughout Earth’s deep history. In their account, no organism can be isolated as a singular actor without an effect on its environment. To support this assertion, proponents of the Gaia hypothesis might cite the example of vibrant marine life in the north Pacific off the coast of Alaska and British Columbia, which are fed by nutrient-rich glacial dust blown from inland mountain ranges.² In this instance, an ecosystem arises from particular climatic conditions, and harmonious exchanges occur over a broad and diverse geographic area.

In this Alaskan example, glacial dust plays a distinct role in the ecosystem, even if its scope and range is dictated by wind and weather. But in many cases, dust challenges the concept of homeostasis. It eludes linear or circular exchange; as literary scholar Steven Connor writes: “Dust is amorphous, without form and almost void. [...] Dust can get everywhere, insinuating itself into every crevice. This makes it a medium of transformation and exchange. Almost without qualities itself, dust has the quality of qualitylessness, the virtual virtue of transmitting the virtues of other substances.”³

Dust’s unpredictability has been exacerbated in important ways by climate change, as when drought and unsustainable farming practices release more dust into the atmosphere. Increased dust can enrich marine ecosystems, stimulating growth; or it can settle on glaciers and quicken snowmelt by absorbing more solar energy.⁴ The “surprising ecology” of dust is an ambivalent part of ecosystems at a global scale.⁵ This very scope is underscored by the recent finding that dust from the Gobi desert serves as a key source of phosphorous for California redwoods.⁶

As the ecologies dependent on—and marred by—dust can suggest, dust control and containment are unattainable

at an atmospheric scale. For engineers tasked with managing dust resulting from industrial processes, similar challenges exist. “Fugitive” dust escapes into the atmosphere as an externality of production. Externalities are waste by-products external to “core” production processes, and as such they disrupt neat, circular geometries of production and consumption. They leak out in all directions, scattering and diffusing, unsettling inside and outside.

Though we may be tempted to cheer for the fugitive escapee, in the case of fugitive dust, its pollutive effects are profoundly detrimental to air quality. In Mississauga’s Clarkson area, citizen-led efforts have worked to curtail these effects through advocacy, research, and industry co-operation.⁷ CRH Cement (previously Holcim) has worked at its Mississauga plant since the mid-1990s to mitigate fugitive dust through the installation of over 100 baghouses, which are cylindrical filters absorbing ninety-nine percent of dust produced in cement production.⁸ These baghouses are emptied regularly to feed most of their contents back into production processes.

Baghouses are engineered filters, employing distinct fabrics for their particular operating temperature and usage, with integrated cleaning systems to ensure that, unlike a vacuum, they filter dust constantly without clogging. A baghouse resembles a large funnel, where dust settles at the bottom, and is mechanically shaken to fall from filters at regular intervals. The volume of dust during created during cement production is no small matter: in the disused indoor facilities which pre-existed baghouse filtration at CRH’s Mississauga plant, dust settles thickly on every surface like snowfall.

Inside and outside the core processes of industrial cement production, dust highlights how circular exchange stands as an ongoing aspiration for contemporary economies. CRH Cement and the Region of Peel, each a producer and manager of waste, both share a stated commitment to “circular economies.”⁹ Per CRH: “The Circular Economy [...] looks to move our society from a linear economic system of take-make-waste to one that considers that materials can have a beneficial use beyond their primary purpose. The goal is to minimize the amount of virgin materials and energy entering our production systems, as well as looking for products that can minimize waste at the end of their use to be repurposed or reconstructed

into something new.”¹⁰ This goal is an admirable one, symbolized and supported by the baghouse: whereas dust once escaped into local airsheds, through citizen advocacy and industry co-operation, it is now largely recycled back into production.

Transitioning to a more truly circular economy is no easy feat. As any visitor to a waste dump will attest, the dominant forms of contemporary human life fail to balance energy inputs with outputs; waste and pollutants continue to accumulate. Whether or not we accept homeostasis as a naturally occurring phenomenon, climate change alerts us to Earth’s connected systems, of which humans are a part. Human beings have already lived in greater balance with non-humans for thousands of years—and in this light, circular economies endure as a worthy aspiration for resource use. Our conception of circularity must, however, come to acknowledge that fungible matter, like dust, often moves porously through the processes and ecosystems we imagine as closed or stable.

Part five of a serial column by a member of *The Society for the Diffusion of Useful Knowledge* team on the physical and material traces of climate change and environmental violence in the region.

- 1 James E. Lovelock and Lynn Margulis, “Atmospheric Homeostasis by and for the Biosphere: the Gaia Hypothesis,” *Tellus* 26, no. 1–2 (1974): 2–10.
- 2 See Kent Moore, *Clouds and Complexity: Viewing the Earth from Space*, Fig. 2, p. 13, in *SDUK 02*.
- 3 Steven Connor, “Pulverulence,” *Cabinet Magazine* 35, Fall 2009.
- 4 Jim Robbins, “Climate Connection: Unraveling the Surprising Ecology of Dust,” *Yale Environment* 360, 30 November 2017, <https://e360.yale.edu/features/climate-connection-unraveling-the-surprising-ecology-of-dust>.
- 5 Ibid.
- 6 Aciego, S. M. et al, “Dust Outpaces Bedrock in Nutrient Supply to Montane Forest Ecosystems,” *Nature Communications* 8 (2017), Article 14800.
- 7 See Joy Xiang, *This, Too Will Contaminate*, p. 21 in *SDUK 03*.
- 8 This discussion of baghouses is informed by conversations with Richard Lalonde, former Environment Manager, CRH Canada Group Inc., Mississauga Plant, during a site visit by Christine Shaw and D.T. Cochrane, December 13, 2017.
- 9 *Roadmap to a Circular Economy in the Region of Peel* (Region of Peel, 2017); “Circular Economy,” CRH Canada.
- 10 “Circular Economy,” CRH Canada.

Local Useful Knowledge: Resources, Research, Initiatives

The Atmospheric Fund (TAF) has worked since 1991 to lower greenhouse gas emissions in the GTA area through policy, awareness, and implementation measures that primarily target the building and transportation industries. TAF works in diverse ways to reduce emissions in these sectors by providing best-practice benchmarks for retrofitting existing buildings, advocating progressive green energy and building policies, and providing grants to municipalities and organizations to advance climate action. In 2017, TAF expanded its focus from its previous mandate covering the City of Toronto alone to include the entire GTHA region. Since playing a key role in Toronto's coal energy phase-out in the mid-2000s, TAF's new implementation-focused programs include improving electric vehicle infrastructure and "deep" energy retrofits to apartment buildings. Entitled TowerWise, the latter program works with architects, landlords, property managers, policy-makers, and residents to improve energy efficiency in high-rise apartments—of which over 2,000 were built during the postwar boom in the GTHA region. Beyond energy efficiency alone, however, TowerWise aims to foster vibrant, proud, and engaged communities in apartment buildings, with the recognition that green initiatives must work in tandem with community health and development.

The Dam is a drop-in centre for youth with locations in the Meadowvale and Cooksville communities in Mississauga. Since 1995, The Dam's programs have supported youth with diverse activities such as day-trips, sports and active games, board-game afternoons, retreats, and mindfulness programs. Aside from structured activities, The Dam's locations simply offer open space for youth to visit and connect with like-minded people outside school, work, or home. Their "Dam-Bassador" program strengthens participants' involvement and input into the organization, by making participants into mentors and program leaders. The Dam's staff highlight its role as a metaphoric "dam," providing a mutually supportive and stigma-free community to empower youth. Likewise, The Dam's full acronym—Develop, Assist, Mentor—suggests how the organization's programs approach care and leadership in varied ways. The Dam's tailored approach extends to its spaces as well: staff describe the drop-in centres both as safe spaces, and as "brave spaces"—that is, places where youth can find the bravery to express their identities and vulnerabilities among peers.

The University of Toronto's **Environmental Governance Lab (EGL)** is a network connecting scholars and policy-makers who work to implement measures that address the challenges of climate change. The EGL's international reach includes partnerships with universities, non-profit organizations, and governments in Australia, Canada, the Netherlands, UK, and US. In one ongoing research project, professors Steven Bernstein and Matt Hoffmann are leading a group of eight EGL members in studying how a transition to green energy ("decarbonization") can be facilitated through state governance and through non-state actors such as industries and citizen groups. In another, UTM professor Andrea Olive is studying civic action (and inaction) on hydraulic fracturing in the Prairies and British Columbia, charting how historically resource-driven regional economies are coping with the entangled everyday realities of climate change and economic development. At an international scale, EGL members contribute to the Earth System Governance Project, an alliance of social-science researchers who advocate for sustainable development and social justice. Locally, the EGL is committed to public-informed research through talks and events, including work-in-progress sessions by PhD students to share and solicit feedback on their ongoing research.

Partners in Project Green is a network of businesses, municipal and regional governments, and conservation authorities working toward creating the world's "largest eco-business zone" in the Toronto Pearson Airport area. According to the Neptis Foundation (a Toronto-based urban think tank), the area they dub the "Airport Megazone" is the second-most significant employment area in Canada. As such, Partners in Project Green links a crucial network of businesses through programs and resource-sharing—from comprehensive energy-efficiency benchmarking services, to the more basic administration of a material exchange program, which helps businesses donate or trade unneeded resources to community partners. Partners in Project Green's tangible actions toward waste and emissions reduction are buttressed by engagements in the area, such as community tree plantings and team-based energy-reduction challenges. The organization shares local environmental research both online and in presentations, and profiles members' energy retrofit successes, thereby inspiring others to learn from

and act on green initiatives. By working both at the level of community-building through green initiatives and through corporate input and benchmarking, Partners in Project Green works to mitigate the environmental effects of air and ground transportation on which the business zone depends.

Peel Poverty Action Group (PPAG) is a citizen-led organization that advocates for the alleviation of poverty throughout the region. The PPAG's efforts are largely focused on its bi-monthly *Tough Times* newsletter, which reports on issues such as affordable housing, food security, access to shelters, settlement services, and more. In *Tough Times*, local MPPs, councillors, trustees, and union leaders are given a platform to discuss how their policies work to address poverty, and the newspaper shares resources for people who are under-resourced or facing poverty. The PPAG holds open public meetings monthly in Brampton and Mississauga; members note the unique issues confronting the area, including unaffordable housing and low vacancy rates, precarious work, and unemployment. The PPAG's initiatives thus serve both to share support and resources for people facing poverty, and to dispel ideals of suburban affluence that proliferate in the region.

Water Allies is a group connecting communities and scholars on water issues in Toronto and the Great Lakes, based at the University of Toronto's New College. The group foregrounds *allyship* as a core aspect of its purpose, stating that allies are formally partnered together in networks of mutual aid and respect. Water Allies' focus on forming alliances is strengthened through its events, which have included walks, discussions, and film screenings—and in July 2019, their Gathering with the Credit River offers three days of Indigenous-led water ceremonies, teachings, and healing sessions. Water Allies invites guests to camp onsite in Erindale Park, crucially claiming space alongside the Credit River where camping is not typically allowed. By connecting diverse communities through allyship—from Indigenous nations and urban Indigenous communities, academics in water policy and engineering, organizations such as Lake Ontario Waterkeeper (see *SDUK02* p. 24) and Decolonizing Water—members of Water Allies advocate for a rooted and connected relationship to water, which looks beyond its characterization as a resource, financial hedge, or source of energy.

Biographies

Laurel Besco is an Assistant Professor for the Institute for Management and Innovation, and the Geography Department at the University of Toronto Mississauga. She received her PhD from the University of Ottawa, and previously attended the University of Waterloo for her MA and BES degrees. Her research interests include Environmental/Sustainability Law and Policy, Green Economy, and Corporate Sustainability.

J.R. Carpenter is a Canadian-born UK-based artist, writer, and practice-led researcher working across print, performance, and digital media. Her pioneering works of digital literature have been presented in museums and festivals around the world. She is a two-time winner of the CBC Quebec Writing Competition. Her first novel, *Words the Dog Knows* won the Expozine Alternative Press Award for Best English Book. Her web-based work *The Gathering Cloud* won the New Media Writing Prize 2016. Her poetry collection *An Ocean of Static* was highly commended by the Forward Prizes 2018.

Randy Lee Cutler is a Vancouver-based writer, artist and educator. She is an Associate Professor at Emily Carr University of Art + Design in the Faculty of Visual Art and Material Practice. In addition to performance and video work, she contributes essays to catalogues and magazines while maintaining an experimental relationship to pedagogy, gardening, and embodiment. Through the intersections of gender, art, science, and technology, Cutler investigates the emergence of new cultural forms and expression.

Adam Dickinson is the author of four books of poetry. His latest book, *Anatomic* (Coach House Books), involves the results of chemical and microbial testing on his body. His work has been nominated for the Governor General's Award for Poetry, the Trillium Book Award for Poetry, and the Raymond Souster Award. He was also a finalist for the CBC Poetry Prize and the K.M. Hunter Artist Award in Literature. He has been featured at festivals such as Poetry International in Rotterdam, Netherlands, and the Oslo International Poetry Festival in Norway. He teaches at Brock University in St. Catharines, Ontario, Canada.

Steve G. Hoffman is an Assistant Professor of Sociology at the University of Toronto Mississauga, where he teaches classes on classical sociological theory, the sociology of disaster, power and cultural politics, and science and technology studies. Hoffman's research focuses on the cultural politics of knowledge production, with a particular interest in the "ontic work" that goes into the production and popular use of simulation techniques and technologies. Although born and raised in Southern California, after spending most of his adult life in Chicago, Buffalo, and

now Toronto, he sees the Great Lakes Region of North America as home turf.

The Indigenous Womxn's Collective is a community who gathers on Lenni Lenape, Algonquin, and Haudenosaunee land to honour themselves and their relatives through art, activism, and education. The Collective, as matriarchs and knowledge keepers, centre their intersectional narratives by practicing accountability and self-determination. They are defined by those who came before them, and those to come. The Whitney Biennial performance action reproduced in this broadsheet was executed by Maria Hupfield and Regan de Loggans. **Regan de Loggans** is an Art Historian and Anthropologist specializing in Fashion and Textile history and criticism, currently the American Art Curatorial Fellow at Peabody Essex Museum. **Maria Hupfield** is a maker, a mover, a connector, and an Anishinaabe-kwe of Wasauksing First Nation. She is also an Assistant Professor of Indigenous Digital Arts and Performance at the University of Toronto Mississauga.

James K. Rowe is an Associate Professor of Environmental Studies at the University of Victoria. He is a member of the Corporate Mapping Project, a research alliance investigating the power of the fossil fuel industry. He is currently completing a book titled *Radical Mindfulness: Facing the Forces of Domination*.

Kristen Schaper is a recent graduate of the Master of Science in Sustainability Management program at the University of Toronto Mississauga. Her interests lie within Conservation and Outreach. She currently works with Credit Valley Conservation Authority and brings educational workshops, presentations and outings to over 2000 youth within the Credit River Watershed.

Camille-Mary Sharp is a Ph.D. candidate at the Faculty of Information, University of Toronto. Bridging the fields of museum studies and political economy, her research reframes discussions surrounding museum decolonization to include funding models—and oil sponsorship in particular.

Alexis Shotwell teaches and writes in Ottawa, on unceded Algonquin territory, where she's a part of the Punch Up anarchist collective. She is the co-investigator for the AIDS Activist History Project (aidsactivisthistory.ca), and author of *Knowing Otherwise: Race, Gender, and Implicit Understanding and Against Purity: Living Ethically in Compromised Times*.

Kristen Simmons is a citizen of the Moapa Band of Southern Paiutes and a doctoral candidate in the Department of Anthropology at the University of Chicago. She currently resides on the Moapa River Indian Reservation in southern Nevada as she conducts field research on atmospherics of the settler state and whiteness.

GLOSSARY

An entangled lexicon for a rapidly changing world

Allyship describes a relationship of alliance, support, and shared purpose. With origins in political, military, and matrimonial relations, allyship today commonly describes how people in positions of power and privilege work in solidarity with marginalized groups (see profile of Water Allies, p. 26). As many in this broadsheet series describe (see Simmons, p. 11; Shotwell, *SDUK03*, p. 8; LEAP Manifesto, *SDUK01*, p. 10, and Whyte, *SDUK01*, p. 8), allyship is not an identity to be claimed, but a relationship to be enacted through trust-building and recognition of systemic injustice.

Currency is specific to a group or nation, and typically refers to a material form, such as paper money and coins. Currency can also refer to objects of value that are alternative to conventional money, see Cutler (cover; p. 3, 16), such as salt (which was historically paid to Roman soldiers, giving us the word “salary”). Currency fluctuations depend on innumerable variables, though D.T. Cochrane (p. 24) argues that prices should also be understood as socially constructed. Adam Dickinson’s poetry in this issue (p. 14) further reflects on relations between currency and social bodies through depictions of bacteria swabbed from money.

Decarbonization aspires toward a low-carbon or carbonless economy achieved through collaborative efforts by all levels of state government, and non-state actors such as industries and citizen groups (see profiles of Musket Transport, p. 22 and Environmental Governance Lab, p. 26). In a recent example, Ontario’s shift from coal-derived electricity was in part inspired by advocacy from The Ontario Clean Air Alliance. But a fully decarbonized electricity grid does not necessarily mean a clean one, as sources such as nuclear power have non-carbon consequences (see Schaper p. 21).

Disaster: An unforeseen accident, natural event, or calamity causing grave damage or loss of life. Disaster is characterized by its abrupt occurrence, which demands coordinated and large-scale response by organizations and state agencies. Amid ongoing global cycles of disaster, some call the exploitation of these events **disaster capitalism** (see Hoffman, p. 8)—where in the interruption of everyday life is opportunistically used to restructure law enforcement, governance, and jurisdiction (see Simmons, p. 11).

Divestment: the reduction or cessation of a set of investments. In the movement for **fossil fuel divestment**, this strategy is used to inspire decarbonization. Hern and Johal (*SDUK02*, p. 5) consider how the Canadian economy is wedded to the oil industry, through perspectives from Fort McMurray. In this issue, Sharp reflects on fossil fuel divestment and broader decolonizing practices in museums (p. 13), while Rowe & Shotwell consider citizens’ implication in colonial dispossession (p. 4).

Epistemology is the study of the nature of human knowledge. Broadly speaking, epistemologies can encompass systems of knowledge and meaning-making, worldviews, and mechanisms for reason and justification. A diversity of epistemological frameworks exist: compare European scientific and museological epistemes (see Sharp, p. 13) with concepts of Indigenous Place-Thought (Davis & Todd, *SDUK01*, p. 12), and the diverse approaches to geology chronicled in Cutler (cover; p. 3, 16).

Extreme weather: Abnormal weather conditions that deviate from recorded patterns in a given region, frequently expressed as floods, heat waves, hurricanes, and significant temperature variations (see **disaster**). In this issue, Carpenter reflects on contrasts amid everyday weather (p. 14), while Hoffman reflects on how disaster management must address the structural conditions that produce unequal exposure to risk (p. 8).

Flight: The action of flying through the air or travelling in an aircraft (Besco, p. 20); the rapid passage of time; a flock or mass of airborne creatures; the action of fleeing (as in military retreat, *white flight* to racially homogenous suburbs, exodus, refuge, escape); and unrealistic plans or ideas (*flights of fancy, flightiness*).

Fluctuation has hydrological origins from the Latin term for wave, flow, and current. Commonly referring to variable or irregular phenomena such as weather and economic markets (Cochrane, p. 24 and Rowe & Shotwell, p. 4), accounting for fluctuation is a way of planning for contingency and unpredictability.

Fracking (or **hydraulic fracturing**) ruptures rock formations for access to oil and natural gas deposits via a forced solution of chemical sand-water into a well. This process requires massive quantities of fresh water, that is ultimately contaminated and disposed of in tailings ponds or through injection deep underground. Oil companies that make use of fracking are represented in the CPP’s investment portfolios (see Rowe & Shotwell p. 4), and the seismic and pollutive effects of fracking continue to provoke widespread resistance (see profile of EGL, p. 26).

Jurisdiction, in its legal sense, refers to the authority granted to a legal body or official, though its common usage refers to the geographic or administrative area overseen by an authority. Jurisdictional limits can pose problems in the context of current climate crises, as with the flow of aviation emissions outside and across state boundaries (see Besco, p. 20), and where pollution and contamination impact communities not responsible for their production (see Simmons, p. 11; Xiang, *SDUK03*, p. 21).

Hydroelectric power is generated from the flow of water through dammed waterways. In Ontario, hydropower generates about one-third of the energy grid across 241 dams (see Schaper, p. 21). Hydropower is often characterized as green energy; but damming introduces infrastructure that can profoundly reshape local environ-

ments, from inhibiting fish migration, to flooding/ebbing shorelines, and often disproportionately affecting Indigenous communities (see Robertson, p. 4 in *SDUK04*).

Immiseration: To make miserable, or render economically impoverished. The term evokes Marx’s “immiseration thesis,” which describes how the impoverishment of working people underpins capitalist accumulation of wealth—for example, through the externalization of costs (see Diamanti, *SDUK03*, p. 16) or through automation and the elimination of paid labour.

Metabolism: The set of chemical processes that occur within an organism to sustain life. These enzyme-catalyzed reactions allow organisms to grow and reproduce, maintain their structures, and respond to their environments. “The metabolism of a body, however, is necessarily connected to the metabolism of the planet and its circulation of energy, resources, and capital” (see Dickinson p. 6).

Offsetting: The payment of fees to mitigate the pollutive effects of a good or service. Offsetting is commonly found in aviation, where passengers can opt to offset flight pollution by paying at the point of purchase (see Besco, p. 20). For critics of offsetting, this same convenience undermines environmental accountability by reducing ecosystems to economic terms; and logistically, critics cite the difficulty of holding beneficiaries of offset programs accountable (see Wood p. 10).

Porosity: A body or thing’s ability to absorb or be permeated by something external to it. Porosity can have the positive metaphoric sense of being responsive and attuned to one’s environment (see Albina in *SDUK04*, p. 6); or, through the felt effects of pollution, it can express the vulnerability of a body to external contaminants (see Simmons, p. 11, and Xiang in *SDUK03*, p. 21).

Smog is a portmanteau (combining smoke and fog) describing severe air pollution made up of mostly nitrogen oxides, sulphur oxides, and ozone. The word was coined in 1905 to describe the new phenomenon of air pollution arising from the coal-powered industrial revolution. The invention of terms that accurately respond to our rapidly-changing climate allows us to take action; for example, Ontario has not seen a Smog Advisory since 2013 after its elimination of coal from electricity-generation (see Schaper p. 21).

Superfund is the nickname for the US Congress’s Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a program that grants the Environmental Protection Agency the power to clean up contaminated sites. Superfund requires parties responsible for contamination to bear the costs (the “polluter pays” principle), or (if no responsible party can be found) provides the funds for site remediation. While Superfund was created to manage toxicity-related public health problems, it has also been criticized for classifying African American and Indigenous communities as lower priority sites for clean-up (see Simmons, p. 11).