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SARAH WYLIE KROTZ

NATURE'S BROKEN CLOCKS

REIMAGINING TIME IN THE FACE OF THE ENVIRONMENTAL CRISIS

PAUL HUEBENER

ADVANCE PRAISE FOR *NATURE'S BROKEN CLOCKS*

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University of Regina Press

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This book is for Niki, Jamie, and Holly.
It is also for Billie Boyd, whose warmth and
strength of character will be felt
for generations to come.

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NATURE'S BROKEN CLOCKS

The environmental crisis is, in many ways, a crisis of time: from the tensions that exist between accelerating resource use and the need for persistent ecosystems, to technologies that will impact the earth for thousands of years, to the quickening pace of extreme weather events and the anxious realization that time, for many humans and other members of the ecosphere, will soon run out, if it hasn't already. Time itself is a central problem of our time, and it is a problem that takes many complex forms.

What business does an English professor have writing a book about the crisis of time and ecological collapse? Shouldn't I be sitting in a wingback chair reading poetry? I would like to suggest that these activities are not quite as unconnected as they might appear, and that they can guide one another in important ways. The work of paying close

attention to narratives, language, and storytelling is inevitably connected to larger forms of cultural experience and meaning. To examine our cultural stories is to illuminate the ways we live in the world. The world is in trouble, and our everyday cultural narratives need to be held accountable. Narratives, after all, are not just found in novels and poems; they take many forms, circulating endlessly within all areas of daily life.

In a book I wrote a few years ago, I used the term *time socialization stories* to refer to narratives that seek to indoctrinate people "into the shared forms of social time that shape the functioning of society."[1] For better or for worse, time socialization stories teach us how to live within our cultural worlds. What kinds of narratives can be understood as time socialization stories? Well, all of them. Whenever we come face to face with any kind of text or representation or narrative—a novel, a poem, an advertisement, a movie, a news article, a press release—we find ourselves facing a particular story about time. This is obviously true for narratives with a clear interest in social acceleration or images of time, but it's also true for texts that might not actually appear to address time in any explicit way. As the literature scholar Mark Currie observes, every story *knows* something about time.[2] Every narrative tries, in some sense, to socialize us into a particular form of cultural time, to draw us into a set of assumptions about how we should understand or experience time. These assumptions are often invisible—and sometimes dangerous—but, thankfully, studying literature and other imaginative responses can help us gain and promote a critical literacy of the temporal imagination. While my previous book examined these concerns within the

human domains of race, class, gender, and Canadian culture, *Nature's Broken Clocks* examines how cultural narratives of time are connected to the problems of ecological crisis.

In the era of climate change and environmental collapse, the stories we tell ourselves about how time works in the natural world are more important than ever. And yet, the narratives circulating within our lives—our everyday ways of imagining natural and cultural time—are failing us. We can't seem to grasp the plodding sequence of events between carbon emissions and the resulting heat, yet we also cannot cope with the shockingly fast onset of climate disasters. We imagine that nature's time is cyclical when in some ways it follows a straight line, perhaps into the abyss. We satisfy ourselves that nature is a place of peacefully slow sunsets and mountains, yet we worry about pandemics that evolve and spread faster than we can respond. We recognize that our activities have disrupted the natural state of the environment, yet we forget that there never was a perfect ecological past. We believe, fatalistically, that the ecosphere is on a straight path into catastrophe, when in some ways even the apocalypse is cyclical. We go about our daily work as though electric lights and always-connected smartphones make the setting of the sun irrelevant, yet our bodies crave nightly darkness and sleep. We think our technologies relieve us of the need to entangle ourselves with nature's time, and that these same technologies will save us by repairing nature's time. We speak of sustainable living even as we face the spectre of the Anthropocene. Our cultural vision of time is a heap of broken clocks.

Telling stories about nature's time is difficult when the timing functions of ecosystems are falling apart in a

bewildering variety of ways. As the environmental humanities scholar Pamela Banting observes, our everyday sense of narrative, which relies on the linear notion of cause and effect, emerged from the relative stability of the Holocene epoch, and it is ill-equipped for the chaos of the Anthropocene.[3] From the sudden acceleration of the warming of the seas, to shocking storms and unprecedented fires, to the distress cries of birds that no longer know when to migrate, the environment can no longer be seen as a stable backdrop to human affairs. The habitats of trees are shifting north more quickly than the trees can spread their seeds. Animals that used to be active during the day are becoming nocturnal in order to avoid us. The climate enters newer and stranger forms of breakdown, sometimes in a slow crawl and sometimes in a stomach-churning lurch. Ironically, one of the few events that still seems to happen with predictable regularity is that every few years a group of scientists warns that we have only a few years left to take action, though this process, too, must eventually break down.

And yet, in the midst of these perils, opportunities arise. The figurative clocks that tick all around us—the delicate forms of time within ecosystems and human cultures alike—contain great potential for imaginative responses and reconstruction. Like it or not, we are all clockmakers faced with the task of rebuilding our knowledge of natural time, a prospect simultaneously terrifying and exhilarating. This book examines the ways in which the clocks of nature and culture have become broken, and it makes the case for a critical approach to our problems of environmental time. Examining a variety of everyday narratives reveals that the way we talk about natural time reflects very human

priorities. We tell stories about nature's time not only to make genuine efforts to understand ecosystems but also to exercise political power, advance economic agendas, express both reverence and anxiety in the face of new technologies, emphasize the elements of nature we think are most important, construct nostalgic visions of an idealized world, protest the destruction of ecosystems as well as the mistreatment of people, enable long-term thinking, and imagine alternatives to industrial capitalism. Sometimes we tell stories about nature's time in order to question all the other stories. Reading these diverse cultural narratives with a critical eye can reveal how they operate, and this will also allow us to piece together a thoughtful literacy of time. At stake in this work of clockmaking is our ability to negotiate the age of ecological collapse.

TELLING TIME WITH CORAL

We might have one last chance to save the coral reefs, or they might already be doomed. It depends on who you ask. If the corals have no chance of surviving, then we have begun an uncanny sort of long farewell, and our efforts to save the reefs amount to a hopeless gesture, an impossible wish to enter a time machine and prevent that which has already happened. Strangely enough, if the corals can still be saved, then this scenario, too, will involve an anxious and delicate form of time travel—or perhaps time tampering is a better term. Untangling the strangeness of the temporality of coral can serve as a useful introduction to the concerns of this book.

The amount of carbon we are pumping into the atmosphere is unprecedented so far back into the geological

record that we have effectively entered a "no-analogue" state in terms of the past 66 million years.[4] We are heating and acidifying the oceans so quickly that we just don't have a good comparison within that span of time in order to figure out what might be in store for today's ecosystems. One thing we do know is that the corals, which can survive only within a narrow range of marine conditions, are now vanishing in front of our eyes. Worldwide, half of all coral reefs have vanished in the past thirty years, and Australia's Great Barrier Reef in particular lost half of its corals in the consecutive heat waves of 2016 and 2017.[5] As three coral experts recently wrote, "It is likely that reefs will be the first major ecosystem in the modern era to become ecologically extinct."[6] They are not talking about the extinction of a species, but of an entire distinct universe of undersea life. One-quarter of all marine species live within communities of coral.[7]

In addition to their status as a unique ecosystem, coral reefs also play an important role in human cultures. Indigenous oral stories from areas along Australia's coast describe a time, over 10,000 years ago, when people lived and hunted on peninsulas which now no longer exist.[8] As sea levels rose at the end of the ice age, the peninsulas became islands and the coast receded inland. One of the stories that records these events "describes several named landmarks with remembered historical-cultural associations that are now underwater." Gradually, as the Indigenous people continued to live along these coasts during the course of ten millennia, some of the newly submerged areas became the Great Barrier Reef, a thriving undersea community growing over the sunken layers of remembered lands.

In her book *The Sixth Extinction*, Elizabeth Kolbert observes that coral reefs also hold a special place of honour in Western history, exploration, and science. The Great Barrier Reef came as a shock to Captain James Cook when it punctured the *Endeavour* during his exploration of Australia in 1770. His journals record his bewilderment at the massive wall of undersea animal-rock that had stopped him in his tracks.[9] Charles Darwin declared during his own travels in the South Pacific that coral reefs "rank high amongst the wonderful objects in the world."[10] His musings about the unfathomable corals contributed to his explosive theories about geological changes that occur over great durations of time.

Much of the very stuff of the earth is made of coral. Limestone, one of the forms of sedimentary rock that is abundant across the surface of the planet, is a hardened mass of fragment upon fragment of ancient corals and other animals that build shells of calcium carbonate.[11] Hulking chunks of this rock, even mountain ranges built of the stuff, are a testament to the lives of these animals across countless ages. The most beautiful caves in the world, formed by the slow erosion of limestone, are the hollowed-out sediments of ancient corals. Humans around the globe have used this coral rock as raw material for everything from the Great Pyramid of Giza to modern-day concrete and toothpaste. Kingston, Ontario, which lies hundreds of kilometres away from any present-day ocean, is known as the Limestone City due to its architecture. We drill into ancient coral to find petroleum, and we add it to our bread as a source of calcium, from which our bodies make our bones. Our own skeletons and the very infrastructures of civilization serve as monuments to the corals of deep time. In killing

the corals that live in the oceans today, we are doing more than cutting off vital marine habitats, the production of great quantities of oxygen, and the livelihoods of hundreds of millions of people;[12] we are reshaping the earth itself and extinguishing our long-term historical companions, one of the species through which human beings have come to build our place in the world. On the path of the Anthropocene, we are leaving behind a fellow traveller who has helped us to know ourselves.

From the corals' perspective, the problem today is not just higher temperatures and increasing acidity but also the rate at which these changes are occurring. It is one thing to adapt to changes that occur at a gradual pace over thousands of years, but another thing entirely to respond to waves of heat that arrive rapidly, one after another, with shorter and shorter pauses for recovery in between. The question of whether corals can survive the changes we are creating in their environment is essentially a question of time. For thousands of years the coral reefs have endured the relatively steady ticks and tocks of their environment, but now their waters are speeding through a period of change too rapid for the corals to catch up. We have broken the clock of the corals' world.

If we have broken the corals' environmental clock, perhaps we can build them a new internal one. For some scientists the solution is a matter of making a faster coral, one that can navigate the accelerated temporality of human-induced climate disruption. At a coral restoration program in Florida, David Vaughan uses a technique called "microfragmenting." That is to say, he takes corals and breaks them into smaller bits in order to make them

grow faster, sort of like the Sorcerer's Apprentice making new brooms spring to life by splitting them with an axe. To recover from the damage, the coral grows at twenty-five to forty times the usual speed.[13] Other conservationists are using electricity sent through steel frames to accelerate coral regrowth after bleaching.[14] A team of researchers on Coconut Island in Hawaii is using "assisted evolution" to speed up the corals' ability to acquire traits that will allow them to survive in new conditions. The scientists "bathe chunks of coral that they've already identified as having strong genes in water that mimics the warmer and more acidic oceans."[15] They are subjecting the corals to a kind of hopeful agony, submerging them in the hostile conditions of an increased pace of life. Whether the goal is to produce corals that grow faster or corals that evolve faster, these projects represent attempts to speed up the very nature of being coral.

Assisted evolution is not a new concept. We have been using it for thousands of years on crops, livestock, and pets, gradually nudging each generation of offspring just a little closer to our chosen ideals. But we must now apply this technique with particular urgency to animals in the wild if we hope to save them from ourselves. The corals do not have thousands of years to spend, and the scientists have entered a race against time. Thomas Oliver, a team leader on the Coconut Island project, claims that the assisted evolution process could potentially be expanded to a much larger scale. "The question," he says, "is not can they do it, it's can they do it fast enough."[16] Another way of putting this is to ask which of our terrible powers moves more quickly: our ability to accelerate the acidification of the seas or our ability to accelerate the evolution of corals.[17]

If the notion of fighting acceleration with acceleration makes you uneasy, this may be because the issue echoes our own unnerving experiences with the increasing pace of life, a cultural phenomenon that poses dangers for individuals and societies as well as the ecosphere. We might not literally be living within electrified steel frames, but the experience of corals that are being compelled to live faster is eerily reminiscent of the fabric of modern life. Sociologist Hartmut Rosa has argued quite convincingly that the much-discussed accelerative pressures of contemporary globalized societies—the widespread sense that life now moves so fast we can barely keep up—can best be understood as the defining characteristic of modernity.[18] To varying extents, the human citizens of modernity *are* these stressed-out corals, submerged under the pressures of a painfully shifting world, hoping to witness our own survival. But for ecosystems, as with people, overcoming the problem of speed by moving ever faster is not a long-term strategy.

In the end, even if all corals do not encounter accelerative pressures in the same way, even if the timelines are diverse and uncertain, every coral on the planet faces a terrible hazard. Amid these complexities, the initiative to accelerate the lives of corals, like other such notions, is both valuable and suspect. Just as the frenzies of modern life compel us to manage our time more rapidly and efficiently, we have decided that the corals, too, must increase the speed with which they adapt. In a briskly changing world, the logic seems irrefutable. Yesterday's corals cannot keep up. We must guide the corals into a faster pace of transformation, creating a new and unfamiliar kind of coral in the process. We must break the corals' clock if we are to save it.

BREAKING NATURE'S CLOCKS

What other natural clocks are we tampering with, and to what end? There is great danger in our ability to reconfigure the timings and tempos of the natural world, yet there is no going back from the changes we have already set in motion, and we must continue to break nature's clocks since our ecosphere faces collapse if things keep ticking the way they are. The toolkit, though, with which we respond to the world's many different faltering clocks needs to include much more than just an acceleration dial. And there is more at stake than the timings of particular animal behaviours or oceanic warming. The environmental crisis is indeed a crisis of time, but responding to this problem is not merely a matter of speeding up or slowing down; it requires untangling the complexities of time in its many cultural and ecological forms.

The word *time* is linked etymologically with the Old English word for *tide*. Both words call to mind the processes of change that shape our experiences as living beings, and the link between the two words evokes the deep connection between our experience of time and our experience of the physical earth; we have always understood one in terms of the other. And yet, for all its immediacy and its connection to the land beneath our feet, time is something we have trouble grasping. Time is a shifting series of apparitions that are difficult to reconcile, and we have significant misconceptions about natural time as well as cultural time.

In anticipation of a recent leap year, the CBC ran a story explaining why February 29 exists and how its occurrence is calculated within our Gregorian calendar. "Leap year," the article explains, "is the reason that seasons occur at

the same time each year."[19] On the one hand, this statement makes perfect sense—if we did not add an extra day into our calendars every few years according to a complex formula, then our calendar dates would gradually desynchronize from the earth's seasons, slowly drifting during the centuries so that summer would sometimes begin in June, sometimes in October, sometimes in March. On the other hand, the statement from the article strangely seems to disregard the fact that the seasons occur regularly each year due to the tilted axis of our revolving planet and that no calendar system invented by humans could have the slightest impact on these orbital patterns. This sense of confusion in the article hinges on the different possible meanings for the word *time*. If "the same time each year" were to refer to the position of the earth relative to the sun, the leap year would be irrelevant. The assumption, though, is that "the same time each year" refers inevitably to the human social system of formal time measurement—indeed, it refers to a calendar that is not even universally human but associated only with certain Western cultures.

This is not to pick on the CBC per se. In the everyday language and logic that so many of us use to understand our place within the unfolding temporality of the world, the fundamental position of the earth itself—the literal common ground beneath our feet—tends to become eclipsed by a particular cultural frame of reference. When we open our perspectives to include not only orbits and tilted axes but also glaciers, coral reefs, and cherry blossoms, and when we consider these things in conversation with our cultural worlds which themselves are part of nature, we begin to notice some of the ways in which our understanding of time

is not quite in working order, as well as the ways in which the unfolding processes of nature's time appear to be broken.

How, then, can we learn to speak about time? Surely, we must make use of metaphors and images to think about this most complex and elusive element of experience. Metaphor theorists George Lakoff and Mark Turner observe that "metaphorical understanding is not a matter of mere word play . . . It is indispensable to comprehending and reasoning about concepts like life, death, and time."[20] Our everyday understanding of time draws its form not just incidentally, but inevitably and fundamentally from the metaphorical assertions that time "moves," "pursues," "steals," and changes things.[21] Another great practitioner of metaphor, Jeffery Donaldson notes that the linking of cause with effect—that is, the metaphorical act of drawing a relationship between one event and another—is the process that creates for us the sense of "time made real."[22] "Metaphor," he observes, "makes us what we are. It is how we got here. It is how we live, how we act, how we think and dream."[23] The very notion of time takes its form through the development of metaphorical thought.

For human beings, then, the concept of time takes shape not merely through the language of science, in which time is understood as a dimension or a theoretical principle, and not merely through the language of economics, in which time is money, but through the everyday practice of figurative thinking. Or, to press the point a little further, scientific and economic explanations of time can largely be understood as examples of, not exceptions to, metaphorical approaches to time. Even science articles, after all, routinely convey aspects of time through diagrams, charts,

and graphs, images of corkscrews, spaceships, and bouncing balls, and descriptions of slices, cubes, lines, film frames, travellers, and funnels—all metaphors. How would we even begin to speak of time without the metaphorical tools of numbers, words, and theory? Indeed, if figurative thinking forms the essence of our explanations of time, then the self-conscious manipulation of metaphor is of fundamental importance. The published body of work by our leading experts on metaphorical thought deserves the attention of anyone who wants to think carefully about time. I speak, of course, of poetry.

Poetic reflections on time find ways to build on, or question, the everyday conceptual relationships that give shape to our experience of time. In his poem "Time, Flying," Brian Bartlett wonders which image might best reflect the particular way that time can be said to fly:

> Is time a moth, a vulture, a paper plane? Are we
> talking of an owl's slow soundless descent
> or the crude creaking of some da Vinci contraption
> made of sticks, leather, and wheels?[24]

Time is all of these things and more. For the young girl in the poem, "time is a hummingbird restless and aglow." Meanwhile, her grandfather "watches the play of darknesses outside the window, / time crisscrossing the yard on its pterodactyl wings."[25] Tellingly, this poem refuses to settle on one metaphor. Instead, it plays a protracted game of the old switcheroo, endlessly swapping out one metaphor for another, until the very act of transformation becomes the purpose of the poem. If we read slowly, the poem gives

us permission to linger on each metaphor, entertaining the idea of time as moth (erratic and fragile), time as vulture (circling in readiness to consume the dead), time as paper plane (made of living material, but processed into something unstable and new). Is this "plane" also a plane of existence, a level of thought, that is made of the words and notions we scrawl on "paper"? Sure enough, the poem moves very quickly from wondering what time "is" to considering what we are "talking" about, as language brings new forms of time to life. The words of the poem conjure these metaphors and texture them, too, as we hear the soft whispering *s* sounds in the "owl's slow soundless descent" and the harsh mechanical consonants of the "crude creaking contraption." The startling enjambment—the line break that occurs mid-thought with the words "Are we"—implies that our relationship with time is so intimate as to take the form of identity. If time is a vulture, are *we* the vulture? Are we time? The poem tells us that no metaphor for time can tell the entire story, and indeed that this complexity is the story. Each metaphor expands our consciousness in a different direction.

The image of the clock, which I am using within this book to reflect the complex and shifting experiences of time that circulate within the natural and cultural worlds, is an icon, an experiment in metaphor, that is both illuminating and deceptive. The clock is one of humanity's most important poems. It is a carefully constructed form in which the chaos of the world is rendered as unified sequence. It is a mirror that reflects our temporal wishes, beliefs, and fears. Like the metaphors in Bartlett's poem, it proposes an intriguing figure for time, but unlike the poem, the clock presumes its own dominance and totality. The time expressed on the face

of a clock is almost perfectly regular, seemingly invariable in its repetitions, and manufactured with astonishing precision through the workings of—depending on the clock—its brass wheels, quartz crystal oscillator, or silicon integrated circuit. Time, as expressed on a clock, is intensely knowable.

The image of the clock, then, takes us in two directions. On the one hand, the clock stands in as the perfect figure for the quest of mortal beings to understand and control the flow of time. Even in a cultural world that is continuously being made over within the processes of globalization, automation, and electronic networking, the centuries-old notion of the clock still remains the ubiquitous symbol for the human experience and management of time. The poetry of the clock is so successful, so useful, so universal, that we read and reread its metaphors each day. The time *is* eleven o'clock. The time *is* six forty-five. The imaginative leap that we take when we read a clock is as familiar, as effortless, as reaching for a light switch in the half-dark. Your body already knows the motion that will illuminate the room. The clock comforts us with clarity and purpose in a bewildering world, and this comfort deserves to be valued. It is the comfort of knowing a language or having a name.

On the other hand, the perfect singularity of the clock makes the image madly inadequate for representing the fluctuations of time within the living, pulsing, irregular world of storms and droughts, hummingbirds and glaciers, poverty and wealth, grief and love. The flawless mirror of the clock can never truly reflect living beings. For all our obsessions over the notion of the "biological clock" that supposedly ticks within our brains, tells us when to sleep, and terrifies us into having children, no such clock can ever exist except

as metaphor. The biological pressures of time on our bodies are all too real, but, as Kevin Birth observes, to imagine that these pressures mimic the mechanical repetitions of cloistered gears and wheels is to speak "as if evolution had anticipated by 70 million years a device invented in Europe maybe 800 years ago."[26] All of this raises troubling questions about our dreams of fine-tuning our inner clocks through sleep-tracking apps and smart lightbulbs. As the supreme icon of time, the clock has always been both elegant and broken.

A key failure of the clock is that, as a monolithic image, it suggests that the hours and minutes of passing time always tick in the same way for everyone. In truth, the case is not nearly so simple; we do not all experience speed, acceleration, or other forms of time equally. On this matter, some of the most important work in the critical study of time firmly agrees with, and extends, the ideas in Bartlett's poem. A scholar of media and cultural studies, Sarah Sharma examines how the everyday labour of taxi drivers, frequent business travellers, and other workers reveals "an uneven multiplicity of temporalities."[27] Taxi drivers and certain hotel housekeepers live on the margins of social time, working exhausting night shifts so that speed-obsessed business travellers can dash to airports at any hour, travel at night, and sleep during the day.[28] Sharma notes that blind adherence to the notion that society is speeding up can obscure "the necessity of tracing how *differential* relationships to time organize and perpetuate inequalities."[29] Because her study shows that time and inequity are closely linked, it confirms that the supposedly universal images of the clock and the high-speed society are embarrassingly inadequate, particularly in terms of entrenched forms of cultural power and privilege.[30]

When it comes to environmentalism, too, the urgency of time is much less equitable than what might be suggested by universalizing images such as the proverbial doomsday clock. One uncomfortable truth, as disclosed in a poem by Sonnet L'Abbé, is that the everyday threat of racist violence might prevent people of colour from spending time participating in the luxury of mainstream environmentalism in the first place:

> Not rising tides, not changing climate, nor soil
> pollutions vex me lately. . . . My heart is meanly
> disconnected from you, friend, whose memory doesn't
> foam with toxic agitation when another story of Black
> life devalued pulses through our consciousness.[31]

The "lately" at the beginning of the poem points to a moment of distraction from the climate crisis, an interruption of environmental thought. But this moment turns out to be more than a mere interruption; it extends uncomfortably and becomes the primary focus of the poem. While the images of "foam" and "toxic agitation" might call to mind the ecological problems of ocean pollution, the concerns of environmentalism fade from view behind the urgent threat of violent white supremacy. Environmental rhetoric often speaks of "our future" and warns that our collective time is running out, but racial injustice fractures the illusion of a collective path into a shared destiny on one planet. For those who face death by racist violence, time has already run out.[32]

Experiences of time are endlessly complex and are always tied to diverse and unequal forms of cultural power,

not to mention the complex limits of ecological resilience; race and class exist alongside gender, nationality, indigeneity, land, and water. We would be dishonest to point to a singular experience of the pace of life, the speed of climate disaster, or time itself as a medium for carrying out environmentalist action. Just as importantly, the very causes of accelerated warming and other ecological disasters are brought about not in equal measure by all people but disproportionately by societies invested in industrial agriculture, fossil fuels, and rapid growth.[33]

This is why some scholars dislike the universalizing tendency of the word *Anthropocene*. With its origins in the Greek root *anthrōpos*, meaning "human being," the word problematically seems to refer to all of humanity, implying that the planet-changing destructive force that has been unleashed is a result of some universal function of the human species, or perhaps a cumulative property of all civilizations. The unfairness in spreading the blame equally between all members of humanity turns two ways: it fails to respect the large portion of humanity whose ecological relations have not caused devastation on such a geologic scale, and it arguably refuses to name the true, more focused cause of the destruction. Perhaps the real issue is the voracious ecological appetite and willful irresponsibility of capitalism, and we are really living in the "Capitalocene."[34] As Justin McBrien puts it, the notion of the Anthropocene "reinforces what capital wants to believe of itself: that human 'nature,' not capital, has precipitated today's planetary instability."[35] Many environmentalists have emphasized the need to rework or terminate capitalism, an initiative that poses a conflict between different visions of time in terms of how we might progress into a livable future.

One of the well-known ironies of the climate crisis is the fact that many people who are among the least culpable for climate change are feeling the effects more deeply, and earlier. The apocalyptic scenarios associated with future climate disasters—the drowned cities, the barren lands, the diseases and droughts—are in many cases present realities for people who have already been marginalized in one way or another, such as people who are Indigenous or poor.[36] As Laurel Blatchford notes, "from Hurricane Katrina in the Gulf Coast to Superstorm Sandy in the northeast, time and again people of color in low-income communities are the first victims of extreme weather and the last to recover from its devastation."[37] This comment from 2016 carried even more weight after the devastating hurricane season in 2017, which caused catastrophic damage in Dominica and Puerto Rico as well as many communities in the southern United States. For the ever-increasing number of people who have faced climate devastation firsthand, the future is now. The Anthropocene, to the extent that the term is accurate, is not simply a universal epoch that divides the history of the planet into phases before and after humankind. It is a roiling chaos of unfolding events that are not equal, or predictable, or fair. It is a spectre that blurs the distinction between the present and the future.

For all these reasons—the temporal complexities of ecology, individual experience, social inequities, race, capital, and the chaos of the unfolding future—the image of a clock carrying out its perfect, singular, blind ticking cannot begin to account for the uneven multiplicities of time. The clock is an image that we must be prepared to question and at times refuse; the seemingly neutral face of mechanized time

is always intertwined with larger forms of cultural politics associated with the environment and configurations of power. The eminent time theorist Barbara Adam has convincingly asserted that Western temporality constitutes "a central part of the deep structure of environmental damage wrought by the industrial way of life,"[38] and in order to question and reverse this structure, we must question the clock, the supreme icon of modern time. Indeed, the various limitations of the clock have made it a maligned object in many circles, not just in environmental thought. Time scholar Michelle Bastian observes that "across a wide range of cultural forms, including philosophy, cultural theory, literature and art, the figure of the clock has drawn suspicion, censure and outright hostility."[39] In this sense, instead of being seen as an image of perfection, "the clock has become the symbol of all that has gone wrong with our relationship to time."[40]

Nevertheless, the very fact that the clock remains the central image of time in late modernity means that we must engage with it, both as object and as metaphor. We cannot dismiss the clock outright, partly because it is ubiquitous and also because doing so would obscure the incredibly diverse set of uses and behaviours that, for better or worse, it makes possible. Bastian's response to those who would seek to reject the notion of clock time hinges on her assertion that clocks "have the potential to be reworked as creative responses to a host of social, political and environmental issues."[41] Clocks are not inert, objective tools but are pliable constructs that can be reshaped for different purposes, and this gives us the ability to critically consider the power relations tied to the production of clock time as well as clocks themselves.[42]

The nature of clocks, then, is not as clear as it might seem, and the embodiment of the clock does not need to remain tied to the literal electronic or mechanical devices whose hands revolve on our walls or whose digits glow on our phones. Clocks can do much more, and the diversity of their expression is limited only by the ways we conceive of them. If I can linger for a moment longer on Michelle Bastian's insights, one of her comments in particular often echoes through my mind. "I want to propose the need for a broader definition of the clock," she writes. A clock can be understood as "*a device that signals change in order for its users to maintain an awareness of, and thus be able to coordinate themselves with, what is significant to them.*"[43] Here, critically, we can expand our sense of what kind of thing a clock might be. She gives the example of leatherback turtles as clocks that are "less predictable, but maybe more accurate for the times we live in."[44] The leatherback turtle is often seen as a relatively permanent citizen of the earth, a link between the present and the deep past, yet it is also facing rapid ecological changes, and its numbers have plummeted because of human activities such as fishing and shrimping. As a result, the turtle "signals change" in complex ways. The temporalities made visible by the leatherback resonate differently for conservationists trying to prevent extinctions than they do for shrimpers hoping to avoid being forced out of a job.[45] Because the "turtle clock" teaches us about the nuances of the ecosystems and cultural systems in which we make our living, it "enables us to maintain an awareness of the inter-meshing relations of turtles, governments, conservationists, and shrimpers. In doing so, it foregrounds the inherent difficulties of coordination in a complex multi-species world,

rather than hiding such work under the cover of a 'universal' time."[46] As an example of a device that signals change, the leatherback plays with the notion of what a "device" might be (in the words of the *Canadian Oxford Dictionary*, "a thing made or adapted for a particular purpose"),[47] and it serves as a living clock that allows us to rethink the diverse expressions of time.

Bastian's expanded definition of the clock opens many possibilities for reimagining how we understand, coordinate, and respond to different forms of time. Equally intriguing is the fact that her definition of the clock could almost just as easily serve as a definition for *narrative*. What is a narrative, if not a device that signals change in some way that is significant to us? The connection between experiences of time and the workings of narrative has long been understood; the intertwining of these two phenomena is elaborated most notably in Paul Ricoeur's massive three-volume work *Time and Narrative*, in which he claims that "time becomes human time to the extent that it is organized after the manner of a narrative," and that "narrative, in turn, is meaningful to the extent that it portrays the features of temporal experience."[48] A narrative, much like a clock, is a kind of gadget for marking time, for trying to make sense of the endless metamorphoses that give shape to our lives.

Narratives not only teach us to know ourselves better but also expand our consciousness in new directions, showing us worlds we had never realized we didn't know. The value of a literary narrative in particular often lies in the means by which it uses the familiarity of everyday language to develop a perspective that is startling and strange to us, a process that always involves socialization into time. When

we become the audience for a story, when we engage with the world as thoughtful readers, we learn to inhabit new configurations of the temporal imagination. With this in mind, we may be able to switch things around—to use the power of narrative to suggest another adjustment to Bastian's broader definition for the clock. A good clock, especially as embodied through narrative, is indeed a device that signals change in order to help us coordinate with what is significant to us, but it also expands our understanding of what is significant in the first place. A good clock, we might say, helps us to fathom our life stories, and it also allows us to become the audience for stories we have not yet heard. Every story is a clock, and a thoughtful one can help us develop a critical literacy of time.

The project of investigating how time moves in the natural world and of understanding both the brilliance and the fallibility of our own notions of ecological time must, to a great extent, involve the practice of carefully, thoughtfully reading our cultural narratives of time. I want to suggest that an everyday form of critical temporal literacy is necessary if we are to understand and respond adequately to the visions of time that enable unsustainable practices. A politically aware critical approach to the ways in which cultural assumptions about time are connected to the problems of ecological disruption—an approach we might call *ecocritical time studies*[49]—can help us read culture with a thoughtful and transformative awareness of the implications of temporal power as well as the need for temporal justice alongside social and environmental justice.[50]

This book illustrates how a critical literacy of the temporal imagination allows us to read, and reshape, the cultural

manipulation of time as it operates in the ecosphere. Only by understanding how time operates socially as an immense but unstable tool of power can we productively investigate the ways in which the environmental crisis is also a crisis in the way we imagine time. And only then can we adequately assess the possibilities for change. Ecocritical time studies equips us to articulate, question, resist, embrace, and reshape the functioning of time as a form of power within our daily activities. The development of this central idea, as expressed through careful readings of the narratives that surround us, will take us on a journey through snowless ski resorts, oil pipeline controversies, exhausting late-night train schedules, the travels of purple martins and king crabs, the onset of pre-traumatic stress disorder in anticipation of ecological collapse, the revival of ancient frozen bacteria, and a poet's smashing of a wristwatch with a rock. I draw my examples mainly from Canada because that is where my expertise lies and because this will ground the discussion. However, I also intend for this project to face outward. Ecocritical time studies can help us to reread the massive social problems of sustainability, not just in Canada but within all spheres of social-environmental practice. Or perhaps *spheres* is not the right word. Following the insights of Sarah Sharma, let us not rely only on the spatial notion of the public sphere but also consider our existence within a "temporal public."[51]

EVEN THOUGH MOST of us do not know the difference between a balance wheel and an escape wheel, each of us makes our living as a clockmaker. Each of us lives within,

and gives shape to, the common narratives that collectively signal our unfolding relationships with natural and cultural time. As Tim Ingold says, we engage with the temporality of the world "not as spectators but as participants."[52] Bastian's idea about turtle clocks shows us one way in which we can tell ourselves alternative narratives of time. The notion provides a sense of how ecosystems can help us rethink our cultural clocks and how reworking our measurements of time might enable us in turn to shift our stance toward our larger ecological contexts. By exercising the skills of critical reading, we can take the jeweller's eye to our everyday narratives, tinker with the stories through which we measure our experiences of time, and direct the ongoing process of their careful reassembly.

Human beings are that part of nature that can self-consciously measure the flow of time through an astonishing number of constructed mechanisms, from mechanical pocket watches, to satellite time signals, to the narratives that constitute the fabric of cultural logic. As a manifestation of nature that constructs and embodies such diverse mechanisms and narratives of time, we are simultaneously nature's clockmakers and nature's clocks. Yet we are also the very part of nature that is straining and disintegrating the timing functions of ecosystems, climate systems, other species, and our own bodies. We are nature's clock breakers and nature's broken clocks. Can we relearn the art of clockmaking by testing the everyday stories that shape our temporal knowledge? Can we relearn to speak of natural time? This book tells the story of five broken clocks, each of which works beautifully to reimagine the time of the world.

THE EARTH

Deep in a lab at the University of Colorado Boulder, a team of physicists have used precision laser beams to suspend atoms of ultracold strontium within a special chamber. The strontium oscillates at a rate that is so mind-bogglingly consistent that the device "can keep perfect time for 5 billion years."[1] It is the most precise clock on earth. And yet, a strange problem emerges when one begins to examine the strontium optical atomic clock. Despite its incredible accuracy—or rather, because of this accuracy—the clock seems to waver, moving sometimes more quickly and sometimes more slowly. As Einstein foretold, the pace of time as measured by physicists depends on the force of gravity at any given position. High above the surface of the earth, time moves slightly faster than it does lower down, meaning that the correct time in two locations will always differ. Normally we would never be able to detect such

minute differences, but the accuracy of the strontium clock is so great that "tiny shifts in the earth's crust can throw it off, even when it's sitting still. Even if two of them are synchronized, their different rates of ticking mean they will soon be out of synch. They will never agree." The researchers have built a clock so accurate that it cannot keep regular time. A clock that works so well it is broken.

Even though the strontium clock seems particularly strange, people have encountered many parallels in the past. The history of clockmaking is largely a story of how advances in technical precision have trimmed off variations in the measurement of time, like a woodworker planing off wood shavings in order to reveal the true form of the envisioned structure underneath. Barbara Adam observes that this process

> results in a fundamental paradox: the measure is designed to the principle of invariance, while the natural time it measures is characterized by fundamental variance. In other words, the hours of daylight change slightly every day, the constellations of the stars do not recur in exactly the same positions, not every year has 365 days. This makes the measure qualitatively different from that which it measures.[2]

In his study of the history of clockmaking, David Landes identifies several key moments in the development of this paradox. "By the end of the nineteenth century," he writes, "this variation had been reduced to a hundredth of a second or less. By this time, clocks were accurate enough to reveal

irregularities in the motion of what had always been the timekeeper of final appeal, the earth itself."[3] The innovation of the strontium clock is that it observes the minute pressures of gravity on the very fabric of space, yet, in a sense, the problem that it poses is different from earlier clocks in degree rather than in kind.

One of the lessons of the strontium clock and its predecessors is that we get into trouble when we assume that there is one correct "time." This clock shows us that every reference body, in effect, is its own clock. Importantly, though, this does not condemn us to isolated islands of time. In practical terms, devices along the lines of the strontium clock could be sent into orbit around the earth, where they could help coordinate our shared understanding of the planet and our universe.[4] In more general terms, the multiplicity of times experienced by all people, all ecosystems, and every grain of sand do not ultimately create a sense of irrevocable fragmentation. Instead, they show us a model of how we might understand a world of shared multitemporal existence. The strontium clock teaches us that no reading of time has the final word and that we are fully capable of living alongside others whose clocks are set differently from our own. More than this, it shows us how we can learn to live in a world in which the clock of the earth is both obsolete and irreplaceable, singular and fragmented, natural and manufactured, essential and broken.

THE ECLIPSE OF THE SUN

In 1838 a Charlottetown clockmaker named John Jury published a notice in the *Royal Gazette* announcing that the sun had become too unreliable to entrust with the keeping of

time. "I wish to inform you," he writes, "that Captain D. and me took the Sun with the Quadrant at 12 o'clock on Thursday the 6th of December 1838 and we proved my time to be correct, the Sun being too fast on that day 8 minutes and 47 seconds. . . . So I hope you see it is impossible for you to regulate your clocks, watches and timepieces by the Sun."[5] Jury's finding may appear idiosyncratic but, as we have seen, it joins a long history of tensions between the time of clocks and the time of the sun and earth.

In its pairing with the earth, the sun has always been the original clock, the most obvious and universal signal of the transformation of morning to evening to night. The sun defines the day, and the idea that its accuracy cannot be trusted is clearly absurd. One of the things that our cultural history of clockmaking has taught us, though, is that the sun, and the larger collection of natural temporalities over which it shines, is worryingly irregular. Because the axis of the earth is tilted and its orbit is elliptical, measuring the day by looking straight up at what might optimistically be called "noon" results in a classification of time that varies throughout the year.[6] We are tremendously privileged to live on a breathing, wobbly planet whose star describes a hospitable if imperfect arc across the heavens, but the eccentricities of the sun and the earth have often frustrated the quest for perfect, regular timekeeping.

In such moments of confusion, I often find myself turning not merely to the technicalities of clockmaking but also to the writing of Don McKay, whose essays and poetry are much acclaimed for their elegant insights into the relationship between culture and nature, and whose important work will be discussed throughout this book. In his

characteristically peculiar way, he has claimed that "memory is the momentary domestication of time."[7] Like any great poetic insight, this comment prods us to reconsider what we thought we knew. In a sense, time is a kind of wilderness, and we have a deep impulse to mark and domesticate time just as we do land. Our structuring of time—the process of converting uncounted time into human memory—involves not only our individual acts of remembering but also the cultural configuration of time through calendars, clocks, and the production of historical knowledge. The use of hours to divide the daylight into segments has been one of the most important mechanisms for the domestication of time and the construction of memory dating back to the days of ancient Egypt but, like the motions of the planet, its social implications are not constant. The machines that consume the feedstock of raw time, grind it up, and churn out the ordered medium of human record-keeping are just as tied to cultural meaning and value as they are to quadrants and wheels.

The use of clocks in early Canada can help us understand how cultural conversations about the implementation of mechanized time affect both our shifting sense of time in general and our experiences of the relationship between nature and culture. John Jury's observation of the sun recalls just how important spatial and temporal measurements were for settler culture in Canada, both at sea and on land. While explorers relied on chronometers to navigate and survey the wilderness, the masses of settlers in Canada navigated their own social existence through a variety of timekeepers that gradually became increasingly accurate and ubiquitous. Historians Jane Varkaris and James E. Connell note that in the late seventeenth century a few wealthy settlers in

New France would have had mechanical clocks brought over from Europe, but "the majority had no access to clocks. They depended on the sundial, the hourglass, the town crier, and the angelus to regulate their days."[8]

The first public clock in Canada was installed in Montreal's Saint-Sulpice Seminary early in the eighteenth century and was maintained under the direction of a resident priest. The maintenance records of the seminary clock tell us that a debate began to take place over whether the clock should be set to "true" time or "mean" time.[9] True time, quite simply, is the time that the sun would project onto a sundial, while "mean" time is a mathematical product intended to average out the irregularities of the earth's motions. In other words, true time takes the measure of the actual sun, while mean time takes the measure of an imaginary sun that moves at a more constant rate. What is more important? Which one deserves our allegiance? The real sun, or a fictitious but more accurate one? The question is a matter of human values, and when it comes to the initiative toward modernity, I bet you can guess the answer.

In his book *History of the Hour*, Gerhard Dohrn-van Rossum notes that the increasing reliability of clock technologies between the seventeenth and nineteenth centuries led communities across Europe to grow skeptical of the time of the sun which, for generations, had been reflected in the authoritative public clocks on church towers and town halls. Highly accurate clocks known as chronometers "gradually discredited the public clocks, for with their help anybody could easily determine that the sun was only a moderately accurate time standard."[10] In major European cities, then in small communities, and indeed in Canada, people began

to switch their public clocks to mean time, thus bringing about the obsolescence of so-called true time.[11] In order to get one's temporal bearings, a person would now tilt their head back and look at the shining face of mechanical time (perhaps blocking out the pesky sun with the back of their hand). Clocks had become more accurate, or at least more regular, than the wobbly earth.

Large questions are at stake in these disputes about the proper relationship between clock time—that multifaceted icon of industriousness, religious devotion, and human mastery of the clockwork universe—and the natural time of the sun's path across the sky. Can natural time truly be abandoned? Does the direction of "progress" move inevitably away from the spin of the earth and toward the clicks and whirs of the latest devices? What sort of world comes about when societies that comprise living, breathing bodies come to inhabit their own mathematical structures of time—when, as Kevin Birth observes, "the alarm clock has more significance than the sunrise"?[12] The church bells, one might say, have been calling the people to kneel before somewhat conflicted expressions of temporal devotion. Even the phrase "true time" becomes misleading; once we have adopted averaged mean time, the true location of the sun becomes in a sense irrelevant. The *real* time is now the socially invented one displayed on the reset clocks.

The day itself has variously been called "the most natural division of time" by Christopher Dewdney, or one of the three natural units of time along with the tropical year and the lunar month, by Malcolm M. Thomson, and there is a deep planetary sense in which these comments are true.[13] What could be more natural than sunrise and sunset?

Yet we can also see that the political and mathematical difficulties of calculating and dividing the day—of figuring out what the day really is—reveal that cultural constructs are always involved in understanding natural temporalities, even while our obsession with counting the hours actually emphasizes the inevitable importance of irregular natural cycles to human activity.

As always, literary texts offer insight into the ways that people develop and experience these allegiances. Joseph Howe, a Nova Scotian politician and British loyalist who edited the *Novascotian* newspaper, wrote a lengthy poem in 1836 called "To the Town Clock," an ode to the Halifax town clock that still sits today atop Citadel Hill, displaying clock faces in four directions. He wrote,

> A "double face," some foolishly believe,
> Of gross deception is a certain sign;
> But thy *four faces* may their fears relieve,
> For who can boast so frank a life as thine.
> You ne'er disguised your thoughts for purpose mean,
> You ne'er conceal'd your knowledge from the crowd,
> Like knaves and asses that I've sometimes seen,
> But what you knew with fearlessness avow'd.[14]

The Halifax town clock, which had been commissioned by the Duke of Kent in 1800, planned by Royal Engineers, and supplied by a team of British clockmakers,[15] held within its origins a narrative of Nova Scotian colonial indebtedness to the British Empire, an image of great value to Howe, who was first elected to the Nova Scotia House of Assembly in the same year that he composed the poem. His description

of the clock—its unwavering honesty, its brave disclosures of truth to the citizens below—reads like a description of the ideal politician, as though Howe is actually writing about himself. The poem says nothing, of course, about how the truths that the clock tells to the townspeople have been finessed through mathematical averaging, or about the socially constructed nature of clock time itself; the truth obtained through the logic of regular mechanized clock time is quite uncontroversially seen here, just as it is for us, as the bare and sole truth.

There is one telling moment in the poem where Howe acknowledges the sun as society's original clock, only to emphasize that the sun has now lost its place as the regulator of human affairs. Howe imagines a citizen of the town who is deeply in debt and tormented by the knowledge that the deadline for paying his creditors is approaching much too soon. This "hapless wight" says to the town clock,

> Hold—hold—good Clock, another quarter stay—
> For if I cannot raise, or beg or borrow,
> My credit will have died before tomorrow,
> For this I do assure you's, my "last day."
> The Sun *stood still*, at Joshua's command,
> Oh! be as kind, or I can never *stand*.[16]

While Joshua, in the biblical precedent, gained more time by asking God to stop the sun in its place, Howe's insolvent citizen extends his plea not to the sun or to God but to the ultimate temporal arbiter of his day, the town's mechanical clock. Kevin Kelly has suggested that "from the very beginning clocks were simulacra"[17]—that is, clocks manufacture

the very temporality that they presume to measure—and we can see in this poem how clock time takes on a life of its own, figuratively eclipsing the sun whose time it ostensibly tracks. Even if God in his mercy descended from the heavens and froze the rotation of the earth, the town clock would still leave Howe's citizen on the hook for the missing cash. The clock's apparently perfect and unfaltering regularity has cemented it as the foundational source of knowledge, trust, and moral instruction.

THE EXAGGERATED DEATH OF NATURAL TIME

Because "To the Town Clock" delights in the unwavering authority of the public clock, it glosses over some of the more complex social pressures and feelings of unease that have also been associated with the transition to authoritative mechanized clock time. In the hands of other writers, poetry can stir up a sense of critique, even arguing that the modernizing world of rigid clock time is a source not of moral instruction but of meaningless pain. Consider Confederation poet Archibald Lampman's late nineteenth-century sonnet "The Railway Station," wherein Lampman describes the train station—in many ways the spiritual centre of nineteenth-century timekeeping—as an exhausting, bewildering, unnatural place:

> The darkness brings no quiet here, the light
> No waking: ever on my blinded brain
> The flare of lights, the rush, and cry, and strain,
> The engines' scream, the hiss and thunder smite:

I see the hurrying crowds, the clasp, the flight,
    Faces that touch, eyes that are dim with pain:
    I see the hoarse wheels turn, and the great train
Move labouring out into the bourneless night.
So many souls within its dim recesses,
    So many bright, so many mournful eyes:
Mine eyes that watch grow fixed with dreams and guesses;
    What threads of life, what hidden histories,
What sweet or passionate dreams and dark distresses,
    What unknown thoughts, what various agonies![18]

"The Railway Station" was published in 1888, three years after the completion of the Canadian Pacific Railway, a project famously understood as a symbol of nation-building, unity, and progress. The poem is contemporary not only with the widespread mechanization of transportation but also with the increasingly urgent, sometimes bitter debates over different forms of social time management in an industrializing world. The tensions, for instance, between traditional agrarian time and the factory workday driven by clocks were well known,[19] and the 1884 International Prime Meridian Conference in Washington, DC, was a key event in what would later become the gradual, and contested, adoption of global standardized time zones.[20] Much was at stake in the ongoing conversations surrounding the intricacies of time reckoning, both in terms of experiences of time within a given situation and also in terms of coordination across different places.

This latter process of coordination, of course, was tightly bound up with the labyrinthine system of massively complex long-distance train schedules. Indeed, the iconic image

of a train conductor holding a precision stopwatch is burned into modern consciousness. Given that railroad transportation was a defining feature of nineteenth-century modernization and of dawning Canadian nationhood, Lampman's description of the train station as a place of chaos and pain is an ironic critique both of the conditions of the nation and of modernization. The imposition of hulking, noisy machinery and industrial technologies is seen here as a threat to peaceful human existence.

For Lampman, the central problem with the railway station, the reason it causes so much grief, is that the scheduling of the rail operations has escaped the constraints of natural time. The station operates at all hours of the day, violating the natural patterns of day and night as well as the natural human rhythms of activity and rest. In his study of the image of the railway in Canadian poetry, Kevin Flynn observes that many early Canadian poets avoided writing about the railway altogether, not wanting to contaminate their high art with descriptions of such a base industrial technology. "Anxious to preserve their pastoral enclosures," he writes, "early Canadian poets regarded the railway as a threat to a way of life and a way of poetry. The train was a sure sign not only of progress but also of the dread, implacable enemy of the pastoral idyll: time."[21] While Flynn's explanation sees the pastoral idyll as a realm removed from the influence of time, it would be more accurate to understand the idealized landscape as a place unadulterated specifically by the industrial temporalities of exchange capitalism, progressive speed, and technological development. The pastoral is certainly not free of time altogether, as the idealized countryside is characterized largely by the slow, meandering

transitions of day to night, summer to winter, wind to rain, all of which intertwine with human rhythms of work and rest, natural temporalities which, in Lampman's view, are now under attack.

"The Railway Station" takes the form of an Italian sonnet, in which tradition dictates that the first eight lines, the octave, will introduce a conceptual problem, while the final six lines, the sestet, will develop a solution or response to the problem. In this case, the octave establishes its sense of despair over the infliction of the railway station onto human life in a number of ways. In the opening lines we see that darkness and light are jumbled strangely together, suggesting a confusion of sensory and temporal experience. The scene appears to subvert the Book of Genesis in which, after creating the light, "God divided the light from the darkness,"[22] an act that brings order and logic to the separation of these primary elements. Lampman's railway station is a place where this comforting separation no longer exists and where the very textures of the world have entered a state of chaos. As Flynn notes, this poem represents a place where "even the most dependable of nature's rhythms are rendered meaningless."[23] Joining the chaotic jumbling of light and darkness is a constant, overwhelming confusion of noises. "Scream," "hiss," and "thunder"—sounds associated with the natural world—have now become the terrible output of the massive engine and its hulking metal parts. The station is an exhausting, bewildering place that is not just unnatural; it actually assimilates and makes strange the very voice of nature.

The railway station's refusal to acknowledge any form of circadian rhythms, its continuous rush and speed, take a toll on the people who use it; they endure pain and exhaustion

as they rush, frantic and bleary-eyed, to keep up with the train schedules. Even the metre of the poem begins to choke under the strain of forward motion. In the line "I see the hurrying crowds, the clasp, the flight," we have to say the three-syllable word "hurrying" in, well, a hurry of two syllables in order to catch up to the iambic pentameter.

At the end of the octave, the train moves "into the bourneless night." The word *bourneless*, which refers to the absence of a limit or boundary, re-emphasizes the confusion between night and day, between darkness and light. A bourn can also refer to a destination or a goal, implying that all the intensive hurrying on the train is actually leading nowhere in particular—it leads only into further darkness. The violence of the railway is made all the more frustrating because it seems to serve no larger purpose. A skeptical reader of the poem might argue that the railroad clearly does serve the purpose of connecting people across distances and facilitating the business of modern life. But by refusing to state any particular reason for taking the train, the poem insinuates that no mere travel plans can justify the terrible chaos of the station.

What about the sestet? What resolution does the poem propose to the problem of the railway station? The sestet draws our attention more closely to the people inside the train. The passengers' eyes, visible only through the windows of the train that encloses them, are at once "bright" and "mournful," as though the fusion of light and darkness that characterizes the station now also shapes the identities of the passengers. Similarly, the people have "passionate dreams" as well as "dark distresses"; they have both "thoughts" and "agonies." The people have, in a sense, *become*

the railway station in all its ambition and terror. They have taken on the chaotic jumble of darkness and light with which they are surrounded. We almost cannot tell whether they are asleep or awake, or even whether these states retain any meaning.

Like the passengers, the sestet contains not only dark, distressing agonies but also a beacon of hope. By focusing not on the train but on the people boarding it, the sestet emphasizes human connections, privileging hopes and fears over noise and steam. Importantly, this "solution" does not resolve the problem of the alienating machinery and the mangling of circadian time; the train remains an imposing and dangerous figure that shapes the context of the scene. And yet, by shifting the focus away from the machine and toward human beings and their individual lives, the poem models a conscious choice to direct our attention, even in the presence of thunderous noise and glaring lights, toward intimate and compassionate humanity.

The purpose of a railway is to connect things, a purpose that Lampman's train fails to fulfill because it causes only directionless pain. In this poem's vision of the world, only shared humanity can hope to forge true connections; the train rushes and screams, but only "faces" can "touch." Where Joseph Howe in "To the Town Clock" assumes that clock time is an absolute authority telling a perfect truth, Lampman offers a perspective that is at once critical and nostalgic. The poem wants to resist the brutal mechanized truth of the clock along with its companion technologies and to advocate instead for a recognition of the truth of the body and its adherence to the natural cycles of light and darkness. The poem implies that the project of resistance

retains value within the context of widespread industrialization, even if this value is perhaps just a matter of lamenting what has been lost.

There is a risk, in Lampman's approach, of seeing clock time and natural time as binary opposites, of assuming that strict clock time has taken over and has left behind only an urge to "return" to pre-mechanized temporalities, an urge that cannot be fulfilled in the modernizing world. This problematic sense of a clear dividing line between modern time and natural time is visible in the contrast between "The Railway Station" and some of Lampman's other poetry; his nature poems tend to portray an idyllic world far removed from industrialization. In "Heat," a poem that meanders along for nearly fifty lines, Lampman describes a tranquil landscape of elm trees, crickets, and cows, where time barely elapses at all. Here, "the sun / Soaks in the grass" and "Even the buttercups are still," while a lone hay cart in the distance "Is the sole thing that seems to move / In all the heat-held land."[24] Lampman remarks at the end of the poem that "some blessèd power / Hath brought me wandering idly here."[25] A similar reverence takes shape in "The Frogs," where "The fingers of the deep hours slowly drew / The wonder of the ever-healing night."[26] Lampman's larger body of work recognizes that natural time lives on, yet it draws a near-absolute distinction between the time of nature and the time of modernity, each taking place within its own insulated world.

This sense of a binary opposition, by no means unique to Lampman, obscures the fact that clock time always enters into dialogue with natural time, interacting with but not erasing ecological temporalities. As Thomas Allen writes,

"Clock time was, to be sure, understood as significantly different from natural and religious time, but it was also deeply intertwined with those other temporal modes."[27] Or, in Barbara Adam's words, "clock time has not *replaced* the multiple social, biological, and physical sources of time; it has rather *changed* the meanings of the variable times, temporalities, timings, and tempos of bio-cultural origin."[28] We might say that the uneasy coexistence of mechanized time with natural time is visible in the fact that Lampman's antithetical poems themselves exist side by side. Juxtaposed with one another, these poems enter into a dialogue about the troubled relationship between different forms of time, even if each individual poem seems disinclined to accept this coexistence. The project of segregating temporalities from one another is always a fragile one. Perhaps, even within a single poem, at least an implied dialogue between opposing temporalities is inevitable; by threatening circadian time, the railway station reinforces the perception of circadian time.

DESPITE THE SHORTCOMINGS of the notion that clock time has "replaced" natural time within human experience, this view has continued to hold sway in many forms. David Landes, for instance, remarks that the clock has severed "human events from nature."[29] Statements along these lines begin to understand the forceful impact of mechanized time yet, taken too literally, they reflect impossibly clean distinctions between the human and the natural, between one form of time and another. More boldly still, Clark Blaise argues that once Sandford Fleming's grand vision of global standardized time zones had finally been implemented, "it

didn't matter what the sun proclaimed at all. 'Natural time' was dead."[30] Still, he places the phrase "natural time" in quotation marks, as if to remind us that the division of sunlight into measured segments was never entirely natural to begin with, or perhaps to suggest that the phrase "natural time," like the word *nature* itself, does not have a single, stable meaning.

If we take "natural time" as an umbrella term for the many forms of ecological or earthly temporalities, then natural time is far from dead. The earth still spins; the rain still falls. Even though we now schedule biological events such as eating and sleeping largely by the clock,[31] these biological needs are never fully domesticated into clock time. And the fact that patterns of daylight, seasonality, and aging remain unavoidably vital for human experience reveals that global standard time did not destroy the temporalities of the ecosphere, any more than did all the other events that have supposedly spelled the death of natural time, from the widespread use of clock time itself, to the switch from true time to mean time, to the use of atomic clocks more accurate than the earth, to the instantaneous networked time of the computer age which, according to Jeremy Rifkin, represents "the final abstraction of time and its complete separation from human experience and rhythms of nature."[32]

The death of natural time has been highly exaggerated; we remain bound to earthly and biological processes, even as we set and reset the clocks by which we seek to regularize planetary motion. The tension that we see in Canada's early clock-oriented culture between the idea that modern technologies signalled humanity's escape from nature, and the idea that the natural revolution of the earth and the

circadian rhythms of our bodies remain critically important to everyday experience, is a tension that remains problematic, and productive, today. The further that technologies of time push us away from the sun and other natural clocks, the more they simultaneously reinforce our dependence on natural time.

WHAT IS NATURAL TIME?

Casting aside the notion that cultural time and natural time each pulses to its own independent beat is a vital step toward untangling the problems of the temporal imagination. Another key step is to concern ourselves with the temporalities of ecosystems themselves in greater detail. Kate Soper once posed the simple question "What is nature?," and she then went on to show that the question is in fact endlessly vexing. When we speak of nature we refer not to a singular entity, but rather, in different contexts, to countless aspects of cultural politics and symbolism as well as ecology and biology.[33] It follows that the question "What is natural time?" must be equally complex, both in terms of cultural visions and in terms of the untold goings-on of ecosystems and their occupants. The question might seem more or less unanswerable, and yet there is a sense in which we assume an answer each time we go about our day. Every act engages with the temporalities of the world around us and takes certain visions of time for granted.[34] Drawing out the implications of this will require some attention to the living earth.

For a planet that rotates once a day, the earth contains astonishing varieties of time. Some of the slower temporalities of the earth unfold through the epochal processes of

tectonic shifts, evolution, fossilization, and glaciation, while these processes in turn contain their own wide variations in pacing. There is a bristlecone pine growing today in the White Mountains of California that is 5,062 years old and counting;[35] it sprouted as a seedling several centuries before the construction of the earliest Egyptian pyramids. While the bristlecone pine is among the slowest of all organisms, it also participates, minute by minute, in the same ecological world that enacts the faster, sometimes astonishingly rapid temporalities of hurricanes, forest fires, and electrons. The bristlecone pine lives each moment within the same unfolding present as *Dolania americana* mayflies, whose adult females live for less than five minutes. I know about this pine in the first place because of its ultramodern presence in an online database that counts its age while keeping its exact location a secret. The pine is half the age of civilization and is also a member of the networked acceleration society.

In a similar observation about coexisting layers of time, Tim Ingold notes that the temporal rhythms of a pear tree vary from the solidity of its trunk, which "presides immobile over the passage of human generations," to the much more rapid growth and decay of foliage.[36] Ecosystems contain as many "times" as they do objects, processes, or creatures—probably more.[37] This can create a great deal of excitement, or perhaps a bit of a nightmare, for the human observer since, as Charles H. Wood has pointed out, studying things that happen slowly can obscure things that happen quickly, and vice versa.[38] If we observe the pear tree intently for one day, or periodically for fifty years, we might never see the fruit.

The rotation and revolution of the earth, too, have many complex expressions. Christopher Dewdney calculates that

as the northern hemisphere moves gradually toward the sun during the late stages of winter, "the shock wave of spring spreads northwards at sixteen miles a day, a little more than half a mile an hour. You could easily outwalk spring."[39] The idea that a season *moves*—or, we might say, saunters—may seem strange, but this is just one example of an ordinary encounter with a tilted planet. In the Arctic, the skewed axis of the earth means that the sun does not set for months on end in the summer and does not rise for long periods in the winter. Arctic caribou have adapted to this by switching off their circadian rhythms of sleep and wakefulness. Instead of relying on circadian patterns, the caribou have developed a habit of frequent napping, falling in and out of sleep at their convenience.[40] Larger seasonal patterns of behaviour may actually suggest that these Arctic dwellers have replaced their so-called circadian clock with a "circannual clock."[41] Around the world, other creatures regulate their behaviour in coordination with an even wider variety of ecological cues. The speckled sea louse in northern Wales uses an internal "tidal clock" to synchronize its swimming and feeding patterns with the tides, while the marine worm *Platynereis dumerilii* spawns during the new moon thanks to its internal "lunar clock."[42] Gretchen Vogel writes in *Science* that these discoveries "suggest that noncircadian clocks might be common and could explain a variety of biological rhythms."[43]

Thinking about planetary motions and the lives of creatures can help to reveal more of what is at stake in the entanglements of natural and cultural time. Ecological expressions of time don't just coexist with but are reciprocally shaped through human activities such as seeding and

harvesting cycles, the breeding of livestock to select artificially for rapid growth, the sudden onset of extinctions, the replacement of old-growth forests with bustling cities, and even the manipulation of our own internal clocks through the use of electric lights. We try to speed nature up by impatiently growing seasonal foods all year long, and we try to slow nature down as we realize just how quickly the climate system is destabilizing. The weather that we are experiencing now reflects the carbon emissions from previous decades and, in the frightening words of Elizabeth Kolbert, "the warming that's being locked in today won't be fully felt until today's toddlers reach middle age. In effect, we are living in the climate of the past, but already we've determined the climate's future."[44] Across these multiple fronts we experience friction and seek control, exercise influence and find ourselves powerless. Resisting the assumption that the human world is separate from nature is an important task of the environmental humanities, and this task becomes more intuitive when we linger on the deep intertwining of human and nonhuman times.[45]

These insights can serve to foster a critical literacy of the temporal imagination, giving us the tools necessary to question common forms of representation that portray natural time as singular or as separate from culture. As readers of our social and ecological worlds, we can remain alert to the limitations of different visions of nature's time, even when those visions appear productive. Consider, for instance, the Slow Food movement. Slow Food encourages people to cherish the lengthy processes of traditional food production, and it usefully seeks to resist some of the ruthless accelerations of late modernity. And yet, Sarah Sharma notes that

> the type of time that is valued by the slow food movement is "natural time," whether it is the time of the earth, the seasons, or the biological clock. It is imagined to be precapitalist and preindustrial. Individuals are expected to reclaim an "essential" experience of time, and such a reclamation is assumed to be possible. But the temporal politics of slow food recedes almost entirely from view because of this naturalized conception of time.[46]

The temporal politics that Sharma refers to include various forms of ideology and inequity. How wealthy does a person have to be in order to enjoy meals that are prepared lovingly by hand over a period of hours or days? How far does a person have to drive in their combustion car (thus speeding up climate change) in order to arrive at a trendy Slow Food destination? Like it or not, the politics of time play a key role in any vision of nature as a pristine site of return to an ideal past. This is not to say that Slow Food is "bad"—it has great imaginative and political potential—but rather to remain alert to temporal power when we speak of nature.[47]

Scholars, just like anyone else, are tied to the limitations of language and perspective, so that when we envision a particular scale or focus for natural time we risk obscuring other ones. This problem works its way into even the most thoughtful writing. In his project about rethinking time within the social sciences, for instance, John Urry advocates for the adoption of what he calls "glacial time," a consciously slow form of social engagement that "resists instantaneous time and seeks to slow time down to 'nature's speed.'"[48] Much like Slow Food, this project is compelling

in its critical resistance of intensively speed-based social politics, yet the equation of glacial time with nature's speed assumes not only that nature's speed is very slow, but more importantly that there is such a thing as a singular speed of nature, an assumption that Urry perhaps begins to question with the use of quotation marks around "nature's speed."

Figuring out how to represent natural time is, and ought to be, a struggle. The perplexing difficulty of capturing the peculiarities of nature's time becomes a focus in Kate Wersan's study of eighteenth-century gardening handbooks, in which she examines how horticultural authors tried to articulate the natural patterns of time relevant to successful gardening. This problem took the form of a "running debate among professional garden authors over how best to represent time on the pages of a book." She writes that "In the pages of their garden almanacs, dictionaries, calendars, and encyclopedias, each of these scientifically minded practical gardeners wrote against mechanical and regularized time, instead proposing different methods to find a more accurate and portable organic timekeeper."[49] This already complex problem became even more difficult when gardeners were faced with new climates and longitudes. Because most published manuals of gardening techniques were based on the growing conditions in England, gardeners in America had to find ways to adapt the timing strategies to their own locations. A vital tool in this regard, both in England and in America, was known as the "early melon," "a melon seedling grown in winter in a box of dung," the process of which "became a widely used method for testing and calibrating horticultural advice."[50] As a kind of living clock, the early melon was "a tool capable of revealing, standardizing, and

teaching organic time. The melon would teach a gardener to perceive organic time, extending the hope of finding in nature a more perfect temporal order."[51] The early melon reflects the impulse, on the one hand, to recognize the unique particularities of time on different parts of the living earth and, on the other hand, to capture and regularize natural time. As a symbol, the early melon speaks eloquently to the limitations of the supposed perfection of mathematical time, revealing that a more accurate clock, as it were, might be found in an ecosystem rather than in an almanac. The melon enacts its own organic time even while it becomes a device that carries the hope of standardized representation.

AS WE UNTANGLE these concerns, Paul Ricoeur's commentary on time and narrative once again becomes illuminating. Much like an ecologist investigating the many living processes within a body of water, the literary scholar examines a collective body of imaginative texts and declares that "there are as many temporal 'experiences' as poets, even as poems."[52] No school of thought can account for all the temporalities of nature any more than a work of literary criticism can construct a final temporal analysis of every poem in existence, or perhaps even of a single poem. An awareness of this limitation must vitally underpin any project that seeks to investigate ecological times. When we equate one particular temporality—slowness, or cyclicality, or anything else—with natural time, we are privileging a single, limited perspective, and denying other forms of timely experience. To suggest that there is such a thing as a singular natural time would make as much sense as arguing that every work

of literature represents social and personal experiences as a homogeneous "literary time." Not coincidentally, this insight echoes the larger conclusions about human time that have been made by various scholars in sociology; human cultural temporalities are incredibly complex and diverse, and it is a mistake to imagine that any cultural temporality can be reduced purely to the influence of clocks, or cyclicality, or any other form.[53]

In Ricoeur's assertion that "time becomes human time to the extent that it is organized after the manner of a narrative,"[54] there is a degree of ambiguity as to what form time might take before it "becomes human time." Even as other elements of the ecosphere are always enacting their own particular temporalities, we might say that human social practices, or even consciousness itself, serve to draw time into the house of culture. We must forever fashion time into human shapes, just as we shape the air to fit inside our lungs. A thoughtful approach to natural time needs to engage as earnestly as possible in the study of ecosystems while also recognizing that human cultures exert a real, but shifting and limited, power of appropriation over different forms of time. A critical vision of the process by which "wild" time is domesticated into human time is necessary for understanding its contexts, biases, exclusions, and limitations. To repurpose Don McKay's words about the practice of nature poetry (another form of wilderness encounter that inevitably involves human perspectives), the domestication of time "should not be taken to be *avoiding* anthropocentrism, but to be enacting it, thoughtfully."[55] We must be critical readers of the cultural narratives through which we shape our encounters with ecological times.

THE GROLAR

Grizzly bears and polar bears have the ability to reproduce with one another, but normally they don't find many opportunities to do so. While the polar bears are busy mating out on the ice, the hibernating grizzlies are still catching their final days of sleep, perhaps just opening a bleary eye. However, as global heating ushers in warmer weather, the grizzlies have been rousing themselves from hibernation earlier in the season, causing them to cross paths more frequently with their polar cousins. As a result, more and more polar–grizzly hybrid bears have been roaming the land.[1]

Andrew Derocher, a professor of biological sciences at the University of Alberta, notes that while they appear to be healthy, "the hybrids are not really adapted to either world. They're not white, so they're not camouflaged for hunting (on ice), and they're not brown, so they're not camouflaged

for hunting on land."[2] What does it mean for a bear not to be adapted to its ancestors' worlds on either side of the family tree? What are the "normal" circumstances for these bears when weather patterns are changing, ice floes are shrinking, and the behaviours and ranges of mates and prey no longer match the predictable patterns?

A debate has emerged over what name should be assigned to the hybrids. Some have taken to calling them pizzlies, while others have proposed the name *nanulak*, from the Inuktitut words *nanuk* (polar bear) and *aklak* (grizzly bear).[3] For now, they are most widely known as grolar bears. The awkward need to develop new language to account for these unfamiliar animals merely echoes the much larger complications facing the bears themselves as they try to make a living in a rapidly shifting array of habitats. The problem of language hints at the confusion that arises when the predictable timing patterns of the natural world become broken.

In the previous chapter I made the point that there is no singular natural time, that the ecosphere and its inhabitants produce countless variations of temporalities. This being the case, the *disruption* of natural time cannot be understood as a singular, linear, or otherwise intelligible event. If nature's clocks are effectively infinite, then there is no practical limit to the ways in which they can break down. This chapter surveys just a few of the clocks of nature that seem to be falling apart, from bird migrations to warming seas, and considers an array of responses. The climate crisis is central to this discussion, although human beings have also manipulated nature's time more intentionally, with impressive and sometimes worrying results for ecosystems, societies, and

our own bodies. I will consider, for instance, the implications of the modern 24/7 society on ecology, social equity, and sleep. The grizzlies, after all, are not the only animals whose slumber has been disrupted.

Many of these examples are troubling, but luckily the long history of cultural manipulations of time provides a starting point for negotiating the new, unfamiliar timings of climate disruption. We can draw from our experience in tinkering with nature's clocks, even as we must radically reshape our expectations of ecological time. Facing this task will require a great deal of imagination, and at the end of this chapter I consider a few forms of creativity, especially those enabled by literature. As citizens of the climate crisis, we need to teach ourselves how to engage with massively disrupted patterns of natural time. Imaginative responses can help us learn to live with broken clocks we cannot even count, let alone repair.

NATURE UNBALANCED

The idea that the natural world exists in a state of "balance" has influenced Western cultural thought for centuries. The Great Chain of Being, a concept inherited from ancient Greek philosophy and adapted through to the nineteenth century, posits that every entity in the universe holds a specific position within a hierarchical structure, with God at the top, followed by other heavenly spirits, down to human beings, then animals, plants, and finally minerals. In his *Essay on Man* in 1733, Alexander Pope claimed that if even one link in the Great Chain were broken, the entire system of universal order would collapse:

> The least confusion but in one, not all
> That system only, but the whole, must fall.
> Let earth unbalanced from her orbit fly,
> Planets and suns run lawless through the sky;[4]

Ironically, the very last unconfirmed sighting of a dodo occurred in the same year that Pope was born. The famous bird, though, was not actually understood to be extinct until after the author's death. Pope would not have realized that this event signalled the irreparable breaking of a link in the chain of being and that, in a sense, it pre-emptively disproved his argument that one broken link would destroy the planet. As his poem suggests, the complete eradication of a species remained a nearly unthinkable prospect.

The vision of a stable, permanent natural order is similarly evident in remarks from Kah-ge-ga-gah-bowh, also known as George Copway, a nineteenth-century Ojibwe missionary author who both embraced and resisted the colonizing European society. His 1847 autobiography, the first book published by an Indigenous writer in Canada, contrasts the ephemerality of human creations against the permanence of nature. Recalling his birthplace near the Trent River in Ontario, he writes,

> I would much more glory in this birth-place, with the broad canopy of heaven above me, and the giant arms of the forest trees for my shelter, than to be born in palaces of marble, studded with pillars of gold! Nature will be nature still, while palaces shall decay and fall in ruins. Yes, Niagara will be Niagara a thousand years hence!

> the rainbow, a wreath over her brow, shall continue as long as the sun, and the flowing of the river! While the work of art, however impregnable, shall in atoms fall.[5]

Just a few years earlier, geologist Charles Lyell had performed calculations of rock erosion at Niagara Falls which revealed, contrary to the biblical interpretations of the time, that the earth must have existed for at least tens of thousands of years. Lyell marvelled in 1830 at the thought that the "calendar" of geological history, the human map of deep time, requires constant revision as we learn more about the immensity of past ages: "No sooner does the calendar appear to be completed . . . than we are called upon to intercalate, as it were, some new periods of vast duration."[6] While Copway's and Lyell's comments are independent from one another, they both speak to the sense that nature's colossal longevity throws the transience and inconstancy of human arts, sciences, and lives into sharp relief. Nevertheless, Lyell's insights into the slow erosion of rock also begin to acknowledge that the configurations of natural forms do shift across the ages of deep time.

As the modern scientific era began to take hold, new discoveries gradually started to dismantle the classical notion of the Great Chain of Being. It was Georges Cuvier's study of American mastodon fossils at the end of the eighteenth century—not the loss of the dodo—that proved to be the key event in helping to establish the revolutionary concept of extinction.[7] More important still was the impact of Darwin's *On the Origin of Species*, published in 1859. As Susie O'Brien notes, Darwin's work disproved the traditional concept of

the natural world as "a closed structure . . . not subject to change." Instead, the principles of evolution "paved the way for the new understanding of nature represented by ecology."[8] At the same time these early studies of extinction and evolution were taking place, the role of human beings in bringing about sweeping changes to ecosystems was becoming increasingly apparent, a problem that found a particularly potent expression in the demise of the passenger pigeon. "By 1860," David Day writes, "pigeon hunting became a full time occupation for several thousand men. With the advent of the telegraph and the railroad, hunters were able to follow and slaughter the migrating birds wherever they landed."[9] The last passenger pigeon died in captivity in 1914.[10] Given all of these events, there would seem to be little justification for hanging on to the vision of nature as a permanent, stable structure.

Nevertheless, despite the realization that ecosystems have always been sites of continuous change, the assumption of stability in nature continues, even today, to hold sway in other forms. John Kricher, a biologist who has famously called the balance of nature a myth, laments the fact that the *idea* of ecological balance seems irresistible. "The balance of nature paradigm," he writes, "is of little value within evolution and ecology. It has never been clearly defined and is basically misleading. But the balance of nature is esthetically satisfying, a fact that is largely responsible for its continued vigor through the ages."[11]

One place where this assumption of stability causes awkward contradictions is in the notion of ecological conservation. In his book *Where Do Camels Belong?*, Ken Thompson questions the notion of conservation by showing that

there has never been a time when ecosystems existed in a stable or ideal form. The way that the earth's species are distributed around the globe "is in practice a single frame from a very long movie. Run the clock back only 10,000 years, less than a blink of an eye in geological time, and nearly all of those distributions would be different, in many cases very different."[12] A study of ancient vegetation in the Andes of Colombia, as perceived through sediment cores, shows that more or less every given moment in the past 2 million years represents a *unique* state; the mix of vegetation is always shifting and never remains the same for very long.[13] Despite this ecological truth, though, the discourse of conservation seems to assume that just prior to the advent of human interference, "the Earth's species were briefly, and for the first, last and only time, not only where they ought to be, but also where they ought to remain."[14] This dubious notion of the ideal "frozen moment," Thompson observes, "has become a dominant and orthodox view."[15] Among the consequences of this vision are the ongoing battles that countries all over the world are waging against invasive species, many of which, Thompson argues, are essentially harmless or even beneficial.

There is a degree of irony in the fact that the era in which humanity has hesitated to let go of the notion of a perfectly balanced nature now coincides with the era in which the ecosphere faces the greatest, most rapid disruptions since before the rise of our species. If it has always been true that nature continuously changes and evolves, this is now *excessively* true. Our collective actions are causing a pace of disruptive change fundamentally different from anything that human beings have witnessed before. Even

without Darwin or the mastodon fossils, the notion of the Great Chain of Being would have had a difficult time modelling the age of human-induced climate disruption and widespread extinctions. Our fantasies about a perfectly balanced nature are poorly adapted for a world in which even the permafrost is no longer permanent.

Naomi Klein observes that "one of the most disturbing ways that climate change is already playing out is through what ecologists call 'mismatch' or 'mistiming.' This is the process whereby warming causes animals to fall out of step with a critical food source, particularly at breeding times, when a failure to find enough food can lead to rapid population losses."[16] This phenomenon is central to many recent observations coming forward from biologists and ecologists, and it illuminates the ways in which the widespread disruption of ecological temporalities poses a complex challenge to our vision of the very structure of the natural world.

Purple martins, whose migration range extends from the Amazon basin in Brazil all the way up to southern Canada, have now been arriving at their northern breeding grounds only to discover that the insects upon which they feed have already started to grow scarce after their spring population boom. The culprit is the fact that spring has been arriving earlier than it used to. Ecologist Kevin Fraser, whose research team outfitted purple martins with tracking devices, notes that the songbirds have been unable to change the timing of their migrations to match up with the earlier onset of the northern spring. Birds with exceptionally long migration routes, he fears, "might be particularly at risk with changes in climate because they're further away and less likely to get the signals they might need of changes up north."[17]

Canadian boreal ducks have been facing similar problems for decades, with some species seeing population declines in the range of 40 to 60 percent since the 1970s. A study of snow cover data in the ducks' northern wetland habitats over a thirty-five-year period found that spring has been arriving, on average, about eleven days earlier than it used to, again disrupting the timing of insect populations. But while certain species of ducks (such as the scaup and the scoter) have suffered severe population declines, other species (such as the mallard) have managed to shift the timing of their migrations, flying to their nesting areas earlier in order to stay synchronized with the earlier spring.[18] The mechanisms behind these differing abilities to adapt are often unclear and unpredictable.

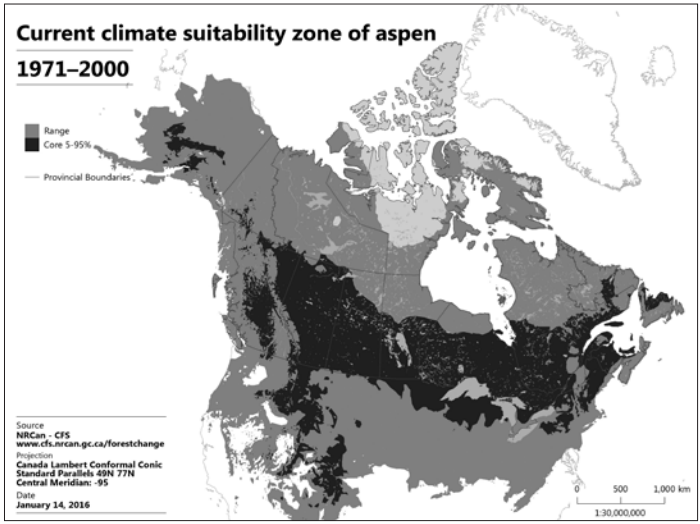
Just as the annual timing of migrations is being disrupted, the physical range within which songbirds can live and nest is getting smaller over time. In particular, the southern extent of many birds' range is shrinking more rapidly than the northern extent is growing. Reporting on this research, the CBC notes that "the prairie warbler—one of the hardest hit songbirds—has lost 170 kilometres of its Gulf Coast range at the southern edge, but gained only 16 kilometres in Ontario on its northern boundary. In many cases, the songbirds are not moving to more suitable areas quickly enough, which is resulting in fewer birds."[19]

The habitable ranges for plants and trees, too, are shifting, meaning that the progression of global heat has emerged as a factor that gardeners must take into account. Banana trees, growing alongside cedar hedges, have started to bear fruit in Vancouver.[20] In Calgary, shrubs such as hydrangeas are not supposed to be able to grow well, but in recent years

they have been thriving. In 2016 the city's plant hardiness zone officially changed from zone 3 to zone 4, reflecting the longer growing season as well as the wider variety of supported plants. Similar shifts have occurred across the country. "Gardeners say don't be scared to experiment," reports CTV Calgary News, "but with new planting zones, it will be trial and error for a while."[21] This notion of trial and error is a particularly suggestive one that I will return to shortly.

While the news might be good for hydrangeas, other impacts are more troubling. The forest writer Peter Wohlleben notes that warmer seasons have resulted in "trees whose sense of time has become confused," causing them to grow new buds and leaves in September, a dangerous waste of energy.[22] Even artificial outdoor lighting can cause trees to grow their buds a week earlier in the spring.[23] Of course, the movement of habitat locations is especially significant for root-bound species. In an investigation of the shifting habitats of tree species within forests across the country, Natural Resources Canada warns that "the rate of projected climate change is unprecedented and, overall, is expected to be 10 to 100 times faster than the ability of trees to migrate in Canada."[24] Like the forms of social acceleration that characterize modern global culture, the acceleration of the warming earth seems to divide ecosystems into life that can keep up and life that cannot. "How many species overall will be capable of moving fast enough remains an open question," writes Elizabeth Kolbert. "In the coming decades we are probably going to learn the answer, whether we want to or not."[25]

While we still have much to learn about the animals and plants that live on solid ground, the massive ecosystems



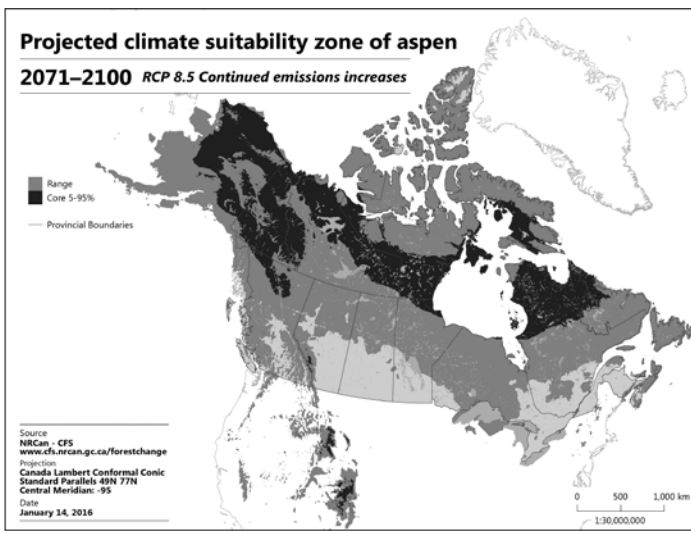


Figure 2-01: Habitable zones for aspens, current and projected. Reproduced with permission from Natural Resources Canada, Canadian Forest Service, 2019.

of the oceans are even more unfathomable. A recent survey of biological data showed not only that the ranges of marine creatures are moving away from the equator but also that the pace of this migration is much faster than anything seen on land—that "many fish and plankton are relocating towards the North and South poles at an astonishing rate of hundreds of kilometres per decade."[26] Of course, different species are migrating and changing their breeding activities at different speeds, creating the familiar mistimings. Species that eat phytoplankton are breeding earlier each year, but while the phytoplankton are also breeding earlier each year, they are not breeding *as* early as their predators, leading to hunger among zooplankton and fish.[27] Some of the habitat movements, journalist Emily Chung writes, "are bringing together species that have never had contact before."[28] For the past 14 million years, Antarctic shelf waters have been too cold to support king crabs, but these predators are now thriving in the waters of the West Antarctic Peninsula, driving creatures such as sea urchins and starfish that evolved in the absence of such threats into local extinction.[29] All of these creatures are grolars in their own way. As ancient as their species may be, the animals have become strange new beasts struggling to belong within an unfamiliar world.

By a great margin, most of the excess heat we create through global warming finds its way into the oceans, and as the warming trend accelerates, so does this absorption process. Between 1997 and 2015—a span of just eighteen years—the world's oceans soaked up an amount of heat energy equivalent to the detonation of 2.4 billion atomic bombs the size of the infamous Little Boy. Prior to 1997, the same amount of energy took 132 years to find its way into

the seas.[30] But as the oceans grow warmer, their ability to absorb heat will become exhausted, forcing more and more excess heat into the air and onto the land.[31] Indeed, there are signs that the seas may already have reached this tipping point, that the oceans can no longer save us.[32] Incredibly, the movement of millions of tons of water away from the melting poles and into the rising seas is imperceptibly slowing the rotation of the planet, like a figure skater extending their arms during a spin.[33]

Many of the above factors indicate that the earth is changing too quickly for species to keep up, but while the need to slow down the effects of climate change is a highly pressing concern, the situation, as usual, is more complex. Seeing the problem strictly as a matter of speed and slowness would obscure the other complexities involved in expressions of time. Trees that grow their buds earlier because of outdoor lighting are caught up in problems of synchronization as well as the blurring of boundaries between night and day. For animals, too, the changing experiences and meanings of the daily rotation of the earth are not so much a matter of speed as they are of the timing of interactions between species. Dozens of mammal species around the world, from possums to elephants, are effectively becoming nocturnal in order to avoid disruptions from people.[34] Even relatively mundane forms of human activity (including the presence of researchers themselves) are so unsettling to animals such as Sumatran sun bears that they have radically shifted their daily patterns of wakefulness and sleep, abandoning their diurnal ways in favour of nighttime activity.[35]

Even the notion that species are having a hard time "keeping up" with the changing planet cannot be generalized,

since it does not account for the startling fact that urban landscapes are in some cases rapidly increasing the pace of evolution. In cities, a number of diverse species populations have developed noticeably different traits within incredibly short spans of time, in some cases only two generations.[36] Finches' beaks have grown larger to fit into backyard bird feeders, a possible new species of underground mosquito has formed inside subway tunnels, and "swallows are evolving smaller, more manoeuvrable wings to help them dodge buildings and vehicles."[37] Nature is fast and slow, prompt and belated, cyclical and linear, desynchronized and beautifully coordinated, all in ways that shift and change each year.

After asking us to hold in our minds a picture of the earth—our familiar planet of thriving cities, grain fields, rivers, and mountain glaciers—the famed environmental writer Bill McKibben stops us in our tracks by saying, "*We no longer live on that planet*."[38] As we watch the global climate crisis remake the planet before our eyes, we see, inevitably, that "the earth that we knew—the only earth that we ever knew—is gone."[39] McKibben's name for the new version of our planet, "Eaarth," is an intentionally uncanny sign of our irrevocably altered world. And yet, revelations like the ones outlined above—the shifting plant zones, the first contacts between alien sea creatures, the radical redistribution of water—raise the frightening prospect that it is not so much that we must learn to inhabit an unfamiliar new planet, but rather that we must continuously *relearn* how to inhabit a constantly shifting world that never settles into a familiar pattern.

Like so many of our thoughts about climate change, the comment from CTV News that the process of gardening "will be trial and error for a while" is both illuminating and

misleading. As gardeners regain familiarity with the ground that has transformed beneath their feet, the frightening and exciting process of trial and error will indeed become central. However, this phase of trial and error will not be a one-time event, or even a stage that lasts "for a while" and then achieves a new point of stability. Rather, the experience of trial and error must be understood as the new reality, as a defining and perpetual condition of life within an era of ongoing climate disruption. Whether we are hobbyist gardeners, professional farmers, forestry workers, fishers, city dwellers, or merely people hoping to live in a stable world, we all find ourselves engaged in a continuous experiment reminiscent of speculative fiction. Even the word *Eaarth* is in some sense too definite, too stable and fixed, to reflect the flux within which we now live.

RECALIBRATING HUMAN CLOCKS

As we learn to live with the metamorphosing temporalities of the natural world, our attention must also turn, inevitably, toward our own human expressions of time. How can we remake our cultural and personal clocks in a world continuously made over by change, a world in which the patterns of the earth and its ecosystems have little interest in thumping out a regular, predictable pulse for our benefit?

The answer to this question lies in the past as well as in the future. After all, humans have always entered into negotiations with the many natural temporalities that both inform and resist our preferred cultural patterns. The histories of human societies are filled with stories about people layering abstract uniform times over the much messier temporalities of planetary revolutions and irregular weather

patterns. In many ways we have even made a living out of tinkering with the timings of our own bodies, a form of clockmaking that makes possible many of the central elements of our modern social world even as it ushers in a host of problems we have never figured out how to solve.

In his historical study of the concept of the week, Eviatar Zerubavel notes that

> the week is the only major rhythm of human activity that is totally oblivious to nature, resting on mathematical regularity alone. Its invention was one of the first major attempts by humans to break away from being prisoners of nature and create an artificial world of their own, and therefore ought to be regarded as one of the greatest breakthroughs in the history of human civilization.[40]

The week defines and facilitates so many of our activities that it feels nearly indistinguishable from the natural daily cycle upon which it builds. The innovation of the week, though, also prevents us from aligning each passing day with the larger structure of our calendar; January 1 can fall just as easily on a Thursday as it can on a Sunday. The odd-numbered seven-day week also means that any activity scheduled to take place, say, twice per week paradoxically cannot occur regularly; sometimes three days will elapse between recurrences and sometimes four days. The "mathematical regularity" of the week is, in some ways, just as eccentric as the wobbly planet it seeks to regulate, yet the week serves as a central idol of social time. Zerubavel

points out that with the advent of the birth control pill, which channels a woman's modified menstrual cycle into a period of precisely twenty-eight days, "conventional multiple-weekly cycles have been asserting their pervasive presence even within the realm of the human body."[41]

There are now many other ways in which the technologies of globalization, as well as the patterns of daily life tied to the labour market and leisure activities, shape human experiences of time on both cultural and physiological levels. With the spread of electric lighting and global telecommunications technologies, work schedules have been desynchronized from daylight.[42] Depending on their field, many employees are expected either to work in strict accordance with clock-based shifts that might occur during any portion of the 24-hour period, or to act as though they are perpetually on call, responding to emails promptly throughout the week, a state that blurs the distinction between workdays, evenings, and weekends, between work time and other facets of life such as family time, play time, and sleep time. As the sinking of the sun no longer corresponds with the end of the day's paid labour, the very concept of a work "day" with a beginning and an end is in some cases obsolete, a deeply problematic condition given that our bodies evolved within recognizable patterns of days and nights, of activity and rest.

Kevin Birth, an anthropologist who studies the interactions between social and natural patterns of time, points out that the standardized 24-hour day also disregards the fact that the natural cues of sunrise and sunset, which inform our bodies' circadian hormonal cycles, unfold very differently in different locations. While the physiological

experience of days and nights is tied closely to geographical location, "the globe has come to be treated as if the experience of time were the same everywhere—as if the Earth were flat."[43] Artificial light also influences our bodies' circadian cycles, yet working repeatedly late into the night does not cleanly recalibrate our biological clocks; after all, we do not have a single internal "clock" that can be reset, but rather a cluster of different hormonal rhythms that do not respond to the same external cues in the same way. Thus, Birth notes, the 24-hour society can bring about "internal desynchronization" as certain bodily processes run out of step with others.[44] A litany of health consequences has long been tied to shift work, and as the globalized clocks and networked devices of late modernity come to define our temporal experiences, many of us start to become different species of micro-shift workers, adrift within an increasingly restless world. The chronobiologist Charles A. Czeisler has suggested that because of its influence on brain hormones, artificial lighting should be understood as a kind of drug.[45]

Jonathan Crary claims that sleep, as one of the last remaining modes of experience in which our attention does not contribute toward profitable activity, "subsists as one of the great human affronts to the voraciousness of contemporary capitalism."[46] He sees capitalism, as well as related processes such as military expansion, as forces that seek to achieve the ultimate extermination of sleep altogether. He notes that the white-crowned sparrow, which has the amazing ability to stay awake for seven days during its migration, is the subject of intense scrutiny by the U.S. Defense Department, which hopes to replicate this ability in its soldiers. "War-related innovations," he notes, "are inevitably

assimilated into a broader social sphere, and the sleepless soldier would be the forerunner of the sleepless worker or consumer."[47]

Questions of social equity are also inevitably tied up in cultural patterns of sleep. Paul Kelley, a neuroscientist who examines how people sleep, has found that young children tend to have a "natural" biological wake-up time of 6:30 in the morning, while teenagers naturally awake later in the day. For eighteen-year-olds the optimum wake-up time is 9:00 a.m. In order to reflect these differing internal clocks more fairly, and to avoid subjecting students to sleep deprivation, Kelley suggests that schools should offer staggered start times each day.[48] College students have also been shown to receive lower grades when their class times clash with their circadian rhythms.[49] What is more, adults tend to return to the natural 6:30 wake-up time when they are in their fifties, meaning that the traditional nine-to-five work schedule is ideal only for older employees, who also tend to hold the managerial positions.[50]

Other studies have shown that the misalignment of daily work routines from our natural sleep patterns increases the risk of obesity and other conditions. This phenomenon, known as "social jetlag," manifests as a chronic condition, suggesting that many people's lives resemble a perpetual state of biological discombobulation, that "on workdays, people may eat breakfast while their bodies still think it's night."[51] From this perspective, too, the expectation that all individuals within a school or a workplace should begin their shift at the same time inevitably favours certain groups over others. So-called flexible working hours have become more common in certain lines of work—a trend that seems

reminiscent of Kelley's call for staggered scheduling—but, as we have seen, this approach in practice tends to introduce its own problems with continuous overwork.

The implications of bodily time go deeper still. Scientists have found that the healthy cells in most people's bodies divide more quickly after the lunch hour. Incredibly, this means that chemotherapy drugs given to cancer patients between 1:00 and 4:00 p.m. are twice as effective at shrinking tumours, while drugs administered outside that window can cause side effects that are five times worse.[52] Other bodily processes also fluctuate at specific times throughout the day, from blood pressure and allergic reactions, which peak in the evening, to coordination and logical reasoning, which peak closer to midday.[53] Researchers in the new fields of circadian medicine and chronotherapeutics are developing a wide assortment of interventions based on these principles.[54] On the one hand, the fact that researchers seem able to identify these patterns and to chart them against the hours of the clock appears to hold out the hope that we might identify some perfect form of clock-based physiological routine. In practice, though, not only are people's bodily responses diverse, but they also exist within the impositions of economics, overwork, and everyday social coordination, all of which complicate our internal rhythms in ways that are deeply nuanced and frequently inequitable.

As many of the examples above demonstrate, conversations about work, sleep, and other everyday uses of time can usefully draw from studies of circadian rhythms and other scientific forms of knowledge, but if the conversation stops there, then important social complexities might not come to light even though they are central to understanding how

human bodies operate through time. As I have mentioned, the work of Sarah Sharma has been important in identifying a widespread structural expectation within the labour market "that certain bodies recalibrate to the time of others as a significant condition of their labor."[55] She uses the term "cab lag," for instance, to refer to the experience of taxi drivers who work long, strange hours.[56] Sharma's insights do not just speak to differences in socioeconomic class; the politics of race and nationality are deeply interwoven into the social conditions within which certain groups are more likely to have to structure their very circadian cycles around the demands of others. Sharma's work gives an example of how we might begin to investigate the ways that inequitable forms of time are actually experienced and felt.

Another method we can use to carry out such work, and one that self-consciously probes the structures of cultural representation within which our experiences of time are always socialized, is, of course, the act of reading literature. Well-written literature can combine precise observational skills with a firm grasp of the importance of representation and meaning. It combines the truth of how the world "really" works with the truth of how it really feels. Dionne Brand's poetry volume *Inventory* is illustrative in the way that it speaks to the shadows that social inequities cast over circadian time. The book portrays the experience of a woman who has taken on the brutal and unending task of keeping a list of the people killed by bombs, guns, and other forms of violence, as reported on TV news and through sources such as the Iraq Body Count project. Near the end of the book, Brand seems to offer some relief by switching the inventory to a list of happinesses, sleep among them,

that still exist in the world. Even sleep, though, takes the form of a darkly ambivalent experience:

> sleep, sleep is infinitely this, and waking
> up, involuntary both, outside one's help,
> circadian and residential, the body must,
> weighed down
> only by the revolutions
> of the earth's incandescence and gloaming[57]

Sleep is joyful relief, yet it is also a form of helplessness; it is a bodily necessity, but also an impossibility, especially given the descriptions of insomnia elsewhere in the book. Sleep is the companion of the earth's familiar daily cycle, yet it is also "weighed down" by "revolutions"—a word that suggests not only the movement of the planet but also political violence and oppression. Circadian repetition is not as comforting when the world is a place of violence, as it too frequently is for people of colour, for the impoverished, for the dispossessed.

Just as late modern culture, in all its complex arrangements, tends to obscure the planetary temporalities of daylight and seasonality as well as the eco-temporal patterns of our own bodies, it has also closed down much of our awareness of how other animals experience and navigate time, and this problem, too, is given imaginative life in literary texts. In his famed book *Never Cry Wolf*, Farley Mowat describes (or, perhaps we should say, imagines) undergoing a process of habituation in order to live alongside a pack of wolves in the Canadian Arctic, a procedure that turns out to hinge on the arrangement of time. Observing that the

wolves lead "a well-regulated life" involving short daytime naps and a variety of activities that take place throughout the day and night, Mowat "did not dare go to sleep for fear of missing something vital."[58] Soon, though, he arrives at an obvious solution: "It was simple. I had only to learn to nap like a wolf."[59] He goes on to claim that these sporadic "wolf-naps" turn out to be "infinitely more refreshing than the unconscious coma of seven or eight hours' duration which represents the human answer to the need for rest."[60]

Mowat faced endless, and perhaps justified, criticism for the less-than-rigorous attention to factuality in his "memoir"; he himself referred to his work in retrospect as a kind of "subjective non-fiction."[61] But the larger impact of scenes such as the one about the wolf-naps remains intriguing. Such a narrative has a defamiliarizing function in that it reveals our everyday experience of temporality as one that is tied not only to a particular culture but to just a single species out of many. By rescheduling his waking and sleeping hours around the time of wolves, Mowat demotes his own pattern of time, showing us that human time is not especially privileged and was never solitary or inevitable. Even if it is somewhat fictionalized, the narrative demonstrates that our consciousness can expand to imagine a world in which multiple species' temporalities coexist.

This is one of many places, then, where literature plays a role in reorienting perceptions of time, recalibrating the fragile clocks by which we muddle through our human lives. In 1998 after extensive research into elephant behaviour, Barbara Gowdy published a novel, *The White Bone*, written entirely from the perspective of elephants who "calculate the passage of time using a complicated method" involving

astronomy, weather, and diet.[62] Somewhat similarly, Thomas Wharton's novel *Icefields* (which I will discuss again later) narrativizes the flow of glacial ice as a process that is agonizingly slow, yet sustained over tremendous periods of time. The novel is, in some ways, the story of the gradual broadening of the temporal perspectives of the human characters who, while negotiating with the capitalist demand for rapid access and development in the glacier, spend decades interacting with the ice. Such writings defamiliarize human temporal constructions and acknowledge the coexistence of other equally real temporalities.

In short, we have a lot of experience with breaking and remaking our own human clocks, both cultural and biological. These clocks were never permanently calibrated through some initial state of operation; instead, they have always been diverse works-in-progress, malleable and susceptible to our continuous reworking. Human life, in its cultural, political, technological, and personal forms, is a cluster of temporal experiments. We have chosen to manage our daily activities through abstract mathematical constructs, to live in radically different locations across the surface of a tilting planet, to wire our homes and offices with miniature electric suns that shine at all hours of the day and night, to connect ourselves to computerized networks of information that never sleep, and to use all of these strategies to empower certain groups of people while in some ways reinforcing inequalities based on race, gender, age, and wealth. We have imagined, entertained, and denied the existence of myriad forms of ecological and animal times both within our bodies and throughout our landscapes. We have seen the power and the risks of these practices. As we learn to

live in the age of rapidly unfolding technological change, social change, and climate change, we ought to know what it means to live as cyborgs of time—as mad time scientists—always testing the shifting ground between natural and cultural temporalities.

TRIAL AND ERROR

Ambivalent as it may be, all the practice we have had in adapting our expressions of cultural and natural time is a resource we need to draw on now that we must continuously reshape our temporal expectations in response to a changing earth. This point comes across with renewed urgency every time a new climate disruption unfolds. One such moment, seemingly more of an oddity than a disaster, happened on Christmas Eve in 2015, when record-high temperatures spread across much of eastern Canada and the United States. The notion of a white Christmas seemed entirely alien as spring-like warmth spread through Montreal (16°C), Ottawa (17°C), and Washington, DC (24°C).[63] Iconic outdoor skating rinks were reduced to slushy ponds, ski resorts found the temperatures too high even to make artificial snow, and several cities set records for high temperatures in the middle of the night rather than in the afternoon. Trudging through the warm rain in New York City, Santa Claus may have worried that his heavy winter coat would become yet another casualty of the twenty-first century. In Washington, he undoubtedly would have noticed that the spring cherry blossoms had started to bloom. Were they blooming "again" or blooming "already"?

While the El Niño weather system was active that year, global heating was, of course, the main driver making 2015

the hottest year on record, a title it immediately lost the following year.[64] People adapted to the unusual weather in December by taking advantage of the extended golfing season or by trying the zip line and the climbing wall at the Blue Mountain "ski" resort.[65] A Twitter user in southern Ontario captured the spirit of both confusion and resilience. Alongside a photo of his dog playing in a beautifully green, sunny park, he wrote, "Happy Canada Day. . . . I mean Merry Christmas Eve. . . . guess if it's going to be warm might as well go all in!"[66] While a single image cannot do justice to the flux of climate change, the conceptual blending of Christmas Eve with Canada Day in a green, grassy park conjures a sense of bewilderment brought about by a planet that is not quite as familiar as it used to be. We now live in a world where northern nations may need to redefine themselves as their central characteristics melt away.

The crises of identity associated with these radical changes are momentous and frightening, twisting the character of society as well as our ability to conceptualize time. Psychologists Philip Zimbardo and John Boyd, who study why some people manage to plan carefully for the future while others remain overly ensnared by present orientation, note that "the development of a future orientation requires stability and consistency in the present, or people cannot make reasonable estimates of the future consequences of their actions."[67] While Zimbardo and Boyd are focusing mainly on economic and political stability, the reliability of ecosystems, climates, and food production is also clearly relevant. In this way, climate change and ecological collapse signal a crisis of both future orientation and the present identity from which such an orientation might arise. Indeed,

the difficulty of responding to a widespread cultural crisis of identity may be one factor in the all-too-common use of denial (and its companion strategy of reckless consumption) as a temporary blockade against the reality of climate collapse. This crisis of time means that thoughtful responses are both especially important and especially difficult. Denialism aside, there are two obvious options, two poles of trial and error, that remain available to us. One is depression. The other is creativity.

Depression is an unappealing response, yet it is to some extent an unavoidable reaction that will continue to shape larger collective responses to the climate crisis. Data from Canada and the United States has shown that the impact of climate-related disasters, such as Hurricane Sandy in 2012 and the massive flood in Calgary in 2013, can lead to a drawn-out increase in reports of depression, insomnia, and experiences of domestic violence.[68] Higher temperatures have been shown to increase rates of suicide, a worrying trend given the increased heating that is now inevitable.[69] Even when obvious disasters are not happening, the constant background knowledge of the reality of climate change is creating a growing epidemic of psychological distress, whose effects can be especially pronounced across populations as diverse as young children, the elderly, new immigrants, farmers, the poor, people with disabilities, members of Indigenous communities, and, of course, climate scientists.[70] For Inuit societies, whose way of life is predicated on familiar patterns of ice cover, the late onset and early melting of the ice reduces the availability of traditional foods, creates more dependence on store-bought products, significantly shifts patterns of daily activity, and reduces the ability

of elders to pass traditional knowledge to younger generations. All of this represents a fundamental threat to Inuit cultural identity, a threat that is now damaging the mental and emotional health of people in places such as the Labrador Inuit community of Rigolet, Nunatsiavut.[71]

As is so often the case with environmental disasters, the psychological implications of the climate crisis can be especially severe for people who have historically been marginalized and subjected to poverty. Rob Nixon describes this systemic inequity as a key principle in understanding "the environmentalism of the poor."[72] At the same time, the inexorable melting of the Arctic ice also highlights the frightening reality that no amount of wealth can possibly protect ways of life that depend on vanishing environments. Interdisciplinary researchers Ashlee Cunsolo and Karen Landman ask us all to acknowledge that "we are entering a time when ecologically based mourning seems likely to occupy more and more of our experience."[73] They show that facing the grief is both necessary and productive, even if engaging in the work of mourning requires laying bare the true scale of what is being lost.[74]

In recognition of some of these concerns, the American Psychological Association has passed a resolution to acknowledge "the current and anticipated psychosocial impacts of climate change,"[75] and some psychiatrists are using the term "pre-traumatic stress disorder" to reflect "the mental anguish that results from preparing for the worst, before it actually happens."[76] Kate Schapira, a worried poet and English professor in Rhode Island, has set up an informal roadside booth offering climate anxiety counselling.[77] The booth itself, not to mention its impromptu clients,

embodies a larger sense of drifting helplessness, but it also sparks a recognition of the forms of creativity that may be possible and necessary.

Creativity, of course, operates across many domains of action, from literature and music to city planning and engineering. As the Christmas Eve crisis of 2015 revealed, the winter recreation industry is an area that is now particularly motivated to exercise creativity in responding to climate change. Resorts in Europe and Australia, for instance, have started blanketing their slopes in plastic tiles to create artificial ski runs that can be used year-round.[78]

One of the more impressive proposals from a winter recreation business was the now-defunct Renaissance project at the Whistler Blackcomb ski resort in British Columbia. The plans unveiled in April 2016, then scrapped in December 2017, were for a $345 million project intended to make the resort "weather independent." New facilities were to include rock climbing and cliff jumping areas, viewing platforms, skateboard training grounds, an indoor wave pool with water slides, and a mountain roller coaster. The project website, no longer online, declared that Whistler Blackcomb was "reimagining the way people play" and promised that "a focus on bringing the outdoors under cover also means guests won't have to stop playing when Mother Nature doesn't cooperate."

Visible in the Renaissance project and its accompanying promotional materials was a sense of the ambition necessary for remaking patterns of social existence in the era of climate disruption—that is, the ambition to engage in "trials." Also visible, though, was the incapacitation, the tendency toward "error," that so frequently characterizes human

responses to radical and frightening circumstances. The Renaissance project was an attempt at maintaining financial and cultural viability for a winter resort in the absence of snow. The sacrificial process by which Whistler Blackcomb would have had to dissociate itself from the wintry conditions that define ski resorts in the first place could be read as a courageous acknowledgement of climate change and a willingness to face the absence of predictable seasons. At its brightest, the strategy represented an inspiring vision of resilience in the face of climate disruption. And yet, the quest to become "weather independent" risked avoiding the larger issue, using the more politically neutral term *weather* instead of *climate* and placing the blame for any disruptions on a lack of cooperation from "Mother Nature" rather than on carbon emissions. There is more than a touch of denialism in the dream that climate change can still be glossed over and effectively neutralized.

Lurking behind the glossy marketing website from Whistler Blackcomb and its notion of weather independence was a sense of anxiety over the unpredictability of the future, an anxiety matched by a tendency to rely ever more heavily on the "solutions" provided by technology, engineering, and apparent inoculation against the ecosphere. The seemingly visionary process of "reimagining the way people play" turns out, in a sense, to reinforce the same forms of imagination that produce an enclosed social collective in the first place. The act of play within late modern consumer culture has always shifted progressively away from unstructured encounters with environments and toward heavily engineered experiences. The more a resort tries to bring "the outdoors under cover," the more

it disengages from both the experience and the politics of nature, converting the process of outdoor play into a guided tour through a walled garden.

The Renaissance project had a polarizing effect in the Whistler community due to concerns about the loss of the resort's identity.[79] The project's ultimate cancellation, which came alongside a promise to return the focus of the resort to traditional features such as ski hills and gondolas, raises its own concerns about the problem of incapacity in the face of a slow-moving but perhaps overwhelming threat. If the Renaissance project represented a spirited but compromised vision of adaptation, its cancellation only temporarily avoids the problem by retreating back into a perilous commitment to the vanishing snows of yesteryear.

Barbara Adam has observed that the economic desire to construct predictable and invariable temporalities within an ecological context—a key component of the modern imagination—tends to exacerbate rather than ease the pressures of unsustainability. "Economic assumptions," she writes,

> stand in a conflictual relation to the processes of nature. That is to say, the neglect of rhythmicity, seasonality, time-scale and intensity of change, the denial of the importance of timing and variability over the life-course, and the disregard for the centrality of reproduction and regeneration are just some of the pertinent time-based discrepancies arising from the application of abstract economics to the temporal realm of ecological processes.[80]

The desire to construct a social realm that is independent from weather, climate, and the many temporalities of the natural world is the same desire that has enabled and compelled people to spend their time in air-conditioned cars and to buy fresh produce throughout the year with little regard for the ongoing events of ecological collapse that these activities often aggravate. An array of observations along these lines allows Adam to develop her larger assertion that Western temporality constitutes "a central part of the deep structure of environmental damage wrought by the industrial way of life."[81]

The intention here should not be to place this burden on the shoulders of a single recreational or industrial development. Many projects, large and small, make compelling yet limited adjustments to the status quo, and these projects hold a promise of bringing about larger conceptual shifts in their own way. Difficulties and failures, after all, are not antithetical to creativity but rather intrinsic to the process. Certainly, resorts like Whistler Blackcomb face a tremendously difficult proposition. Still, as the public is bombarded continually with warnings, predictions, and reports, our collective envisioning of a world in flux demands additional responses.

The notion of a four-day or three-day work week, which has been advanced by public figures, including Naomi Klein, represents a more radical, and particularly temporal, form of creativity in response to climate disruption, and it serves as a good example of a counterpoint to the economic vision in which technology and capitalism represent the totality of social imagination. A full-time work week made up of either three or four eight-hour days would not only foster more humane experiences of work time and leisure time but

could also slash our collective carbon emissions by a great margin. "Overworking," Klein notes, "is intimately tied to a particularly wasteful model of consumption—you have no time after work to do anything other than grab a takeaway, and less time for low-consumption activities like cooking."[82] David Suzuki observes the same problem, remarking that "Well into the 21st century, we continue to work the same long hours as 20th century labourers, depleting ever more of Earth's resources to produce more goods that we must keep working to buy, use and replace in a seemingly endless cycle of toil and consumerism."[83] The politics of time are central to these concerns.

Some have argued that a shorter work week is not a realistic option for people with low or even mid-range incomes who depend on each paycheck, but this argument misses a central plank of the proposal for a shorter week: the reduction in working hours should not amount to a reduction in pay. The New Zealand trust company Perpetual Guardian, for example, initiated an experimental four-day work week in 2018, during which they still paid their employees for a five-day week; the trial run resulted in increased productivity and happiness, and the company decided to make the policy permanent, also giving employees the option to work five shorter days if they prefer.[84] Other trials along these lines have taken place in the United Kingdom and elsewhere, as have experiments with the closely related notion of a guaranteed minimum income, which would partly decouple income from work.[85]

By critiquing the dominant expectation of how people spend their time during the course of a week, these ideas deploy a form of temporal creativity with the potential to

reduce social and ecological hazards. In doing so, they face off against entrenched financial principles and the capitalist allocation of profits to the highest levels of the economic hierarchy, and this represents the greatest challenge to such proposals. While advocates of a shorter work week tend to believe that the adoption of "labour-saving technologies" such as automation will effectively pay for the time that employees spend away from work,[86] the capitalist acceleration society has always defined itself largely by using such technologies to increase the amount of productivity and profit that can be extracted from each worker.[87] Time-saving technologies *could* be used to let people work fewer hours for the same pay, but they *are* used to make people work faster, and to carry out mass layoffs. This means that the fight for a shorter work week is really a fight against the capitalist imagination, a system of belief that does not operate on the level of individual companies or public services but on the level of the globalized acceleration society. As long as the capitalist vision of work and time remains entrenched, individual trials of a shorter work week will remain just that: precarious exceptions. The creative project has never been easy. If radical economic and labour policies are to stand a chance, they must join forces with other means of creative initiative, with methods of thought whose very purpose is to challenge the collective cultural imagination.

One of the cultural practices that has long exemplified such a creative initiative is, of course, literature. Discussions of literary texts may seem misplaced alongside surveys of avian migration patterns, critiques of resort engineering projects, and challenges to the capitalist economic order. And yet, there is something to be said about assertions such as the one

Ursula K. Heise makes in her study of the cultural factors tied to mass extinction, that "biodiversity, endangered species, and extinction are primarily cultural issues, questions of what we value and what stories we tell, and only secondarily issues of science."[88] Bill McKibben finds resonance in this notion as well. Following a trip with two poets to a melting glacier in Greenland, he remarked that he has "spent 30 years thinking about climate change—talking with scientists, economists and politicians about emission rates and carbon taxes and treaties. But the hardest idea to get across is also the simplest: we live on a planet, and that planet is breaking. Poets, it turns out, can deliver that message."[89] What literature in particular brings to the table is a vital ability to both uncover and reorient human frames of experience, in a way that is both private and social, contemplative and inciting. As Catriona Sandilands argues, "literary texts in themselves, as points of environmental activity, contribute through critical practice to an environmental public culture."[90] Far from existing within a secluded artistic enclave, literature can enact "an interruption of the totality of environmental discourse constituted outside the literary domain."[91]

Moreover, if narrative, as Ricoeur suggests, is the primary mechanism that we have for ordering and comprehending time, for making time human, then thoughtful literary texts should be among our most capable tools for expanding, questioning, and shaping our awareness of the contested temporalities central to human–ecological relations. By contemplating the flow of time in various parts of our cultural and ecological worlds—by asking how time might be said to move for a forest or a rock as well as for human beings amid technological infrastructures—literary writers have been able

to interrogate the limits of cultural conceptualizations of time and comment on the human place within both time and the ecosphere. How might readers of Archibald Lampman's "The Railway Station" begin to reassess the merits of the five-day work week and its economic logic?

These principles can operate across any number of topics, but in the spirit of the grolar bear, let's come back to representations of animals. Janice Fiamengo has said that "'speaking for' animals in Canadian literature . . . has always been double-edged: both an exploration of the radical otherness of the animal and an intensely human, and human-centred, endeavour."[92] As the poem I discuss below demonstrates, this double-edgedness can become a means of thoughtful anthropocentrism through which insights into nonhuman experience, precarious as they may be, might reshape cultural patterns of thought. This poem is both an expansion of our creative capacity and an identification of its limits—a trip outside of human time and an act of mourning for our imprisonment within human time. It is both trial and error.

Margaret Atwood's "Bear Lament" (2007) sees an encounter with a polar bear as an opportunity to subvert a problematic view of time in the natural world. The poem is addressed to "you," whose romanticized conceptualization of the bear's static existence in time gradually breaks apart over the course of the poem. With apologies to Atwood, I have italicized the poem's temporal phrasings to emphasize this shift:

> You *once* believed if you could only
> crawl inside a bear . . .
> this would

save you, in a crisis. Let you enter
into its cold wise ice bear secret
house, as in *old stories.* In a desperate
pinch. That it would share
its furry winter *dreamtime* . . .
    But no,

not any more. I saw a bear *last year,*
against the sky, a white one,
rearing up with something of its *former*
heft. But it was thin as ribs
and growing thinner. Sniffing the *brand-new*
absences of rightful food
it tastes as ripped-out barren space
erased of meaning. So, scant
comfort there.
    Oh bear, what *now?*
And will the ground
still hold? And *how*
much longer? [93]

The sequence of temporal language begins with the fairy-tale opening "once," the mythical "old stories," and the eternal "dreamtime"; that is, the bear is perceived to exist in an alternate reality beyond the forces of temporality and causation to which everyday human events are subject. With the words, "But no," however, the poem rejects this romantic vision of nature as a static refuge and inviolable home of eternal balance, and it moves jarringly into the real anxieties of the immediate past and the ongoing present with the phrases "not any more," "last year," "former," "brand-new,"

"now," "still," and "how / much longer?" Even the shift in verbs from the imaginative temporality of the conditional tense ("could," "would") to the specific moments of the past tense ("saw," "was") to the immediate present tense ("tastes"), and finally to the future tense ("will the ground / still hold?"), sees the poem's temporal condition migrate from comforting fantasy to uneasy actuality and fear for the very real future.

The poem does not name the cause of the bear's unstable ground and lack of food, though global warming is clearly implied. Atwood's language is suggesting that the unprecedented human assault on the biosphere destroys not only animals and ecosystems but also the romanticized view of nature as a stable realm independent of human affairs. Her observation of the changing Arctic wrenches the bear from its reassuring atemporality, placing it precariously within the increasingly barren present—a land of "brand-new / absences"—and it is her close attention to temporal language, the same temporal language with which we negotiate every time we speak, that accomplishes this shift.

The result is that the "ground" of our cultural view of nature as an unchanging landscape is fractured along with the ice. The poem acknowledges that despite several centuries of evidence to the contrary, the notion that life on earth is ordered through a permanent set of relationships has retained its hold within the collective Western consciousness much longer than it has any right to. By compelling herself, and her readers, to finally reject the notion that nature is stable—and thus to reject the secure concept of nature altogether in favour of a more critical awareness of changing ecosystems, temporal ideology, and our own culpability in bringing about the deadly volatility of the

present age—Atwood offers a lament not only for the polar bear but also for a damaging cultural belief in a stable natural time unaffected by forms of discourse and social power. In this sense, the title of the poem reads in the imperative. *Bear* lament: give birth to, and carry with you, the necessary sadness that has been denied for so long.

Every poem, like any other form of representation, must develop a filter to shape its point of view. In the case of "Bear Lament," the poem happens to remain silent on the importance of Indigenous perspectives on polar bears and the larger changes facing the north. This limitation of the poem is perhaps especially notable given Heise's observation that the Western use of the polar bear as a charismatic icon of the ravages of climate change—through which the bear sometimes serves almost as a cartoonish mascot—may fit uneasily alongside the points of view of members of Inuit communities who see the health and behaviour of the bears within a more nuanced context. In this sense, "the bear turns into a symbol of struggle over cultural and political sovereignty."[94] As with any form of representation, then, the politics of "Bear Lament" expand when we consider what is *not* said. The poem wants to question Western models of time from within, but in doing so it risks participating in the means by which Western knowledge has often failed to respect the voices of those who have lived alongside polar bears for a very long time.

Like the grolar, the bear that does not belong and has no name, Atwood's poem sparks a recognition of how environmental destruction can compel us to rethink our view of ecological time, even if the critique in the poem, like so many other projects of creativity, remains troubled

and incomplete. "Bear Lament" protests the difficulty, and declares the necessity, of rejecting the comfortable notion of stability in the natural world. As both trial and error, the poem offers a model for working through a re-evaluation of Western cultural visions of nature's time, and it also serves as an example of how such efforts can fall short. Errors will always be the companion of trials, especially when we too, perhaps, are grolars navigating a shifting assemblage of flailing ecosystems. Our own process of survival requires burying the old stories that we have been telling about nature as resource, about work and rest, about solid ground and settled seas, the known and the strange. Only through grieving the loss of our comfortable assumptions can we take up the call for a critical literacy of time in a changing world.

THE SKELETON WATCH

Whatever you do, never conduct research on luxury mechanical wristwatches. An otherwise reasonable person, upon witnessing the artisanal production methods, the impossibly minute handcrafted components, the elaborate engraving, enamelling, arabesque patterning, and *guilloché* ornamentation, all lovingly fostered within eminent watchmaking workshops, can begin to realize that the prospect of spending $70,000 on a luxury Swiss watch makes complete sense.

Unfortunately, the project of understanding cultural ideologies of time inevitably requires examining the material artifacts—the clocks, calendars, phones, and, yes, watches—through which individuals negotiate their day-to-day temporal experience. As a result, the aspiring practitioner of critical

time studies proceeds into treacherous and potentially bankrupting territory.

My own encounter with this predicament, the climax of which occurred when I found a job as an assistant professor, is illuminating in the sense that it occupies the intersection of everyday lived time, capitalism and consumer culture, and the mesmerizing force of cultural models of time that structure uneven experiences within the larger ecological context. Like so many personal narratives, mine is a story about both the beauty and the danger of cultural time.

For those who have mercifully not been initiated into the academic job market in the humanities, it is important to realize that many of the most dedicated, rigorous scholars of our generation—people who are conducting truly groundbreaking research into the profound complexities of human experiences within diverse social histories, inequitable cultural politics, and collapsing ecosystems—are being systematically pushed, in many cases heartbroken and impoverished, out of their fields of expertise. Volumes have been written about the neoliberal causes and democratically distressing consequences of this trend.[1] Suffice it to say here that the chances of a highly qualified doctoral graduate finding secure employment as a tenure-track professor can often feel, to quote Douglas Adams out of context, "roughly comparable to that of dropping a ball bearing at random from a cruising 747 and hitting, say, an egg sandwich."[2]

You can imagine, then, the state of shock I entered upon landing an assistant professorship. There I was, a hapless recent PhD graduate whose postdoctoral funding had expired. I was on track to bring in a solid $12,000 that year from contract teaching while supporting a family of three

in one of Canada's more expensive cities. During the four-year duration of my job search there had been, give or take, one tenure-track job posting in my entire field somewhere in the country each year. I had just made the monumental decision to give up on the career I had spent the previous sixteen years working toward and had turned my attention to aimlessly scraping together a LinkedIn profile, when, all of a sudden, I was offered a job interview and then a job. For some inexplicable reason I had been granted the opportunity that so many of my friends and colleagues have been denied, not because they did anything wrong but despite the fact that they did everything right.

There is a sense of survivor's guilt, well known among those in the field, that emerges in such a moment. At the same time, there is an understandable desire to celebrate extravagantly. For me, the guilt still lingers and does not have any obvious remedy; the only hope is to do my job well, support precarious colleagues and students as best I can, and publicly promote the importance of the humanities. The celebration, however, manifested for me in a very tangible way. Naturally, I decided to purchase a fancy watch.

Like all skeleton watches, the one I now wear reveals the inner workings of its timekeeping mechanism. When you look into the face of the watch, you can see the mainspring coiled up tight if the enclosed rotor has been swinging on your wrist all day, or slightly uncoiled after resting on the bedside table during the night. The mainspring propels the gear train, to which the hands of the watch, poised in readiness, are connected in series. The gear train urges the escape wheel to rotate counter-clockwise, which it cannot do until it is released by the rocking pallet lever that has captured

one of its teeth. With each rise, the pallet lever propels the golden balance wheel—the wristwatch's more frantic version of a pendulum—which twirls madly back and forth, pushing the pallet lever back down to capture a different tooth of the escape wheel with each precisely timed spin. The escape wheel clicks forward, releasing trapped energy into the gear train at the rate that the balance wheel allows. At this precise rate, the second hand revolves. A skeleton watch makes visible the astonishing way in which an elaborate series of tiny mechanical parts can perpetually churn out accurate seconds and minutes without any need for electricity. My watch is not exactly a $70,000 masterpiece, but it nevertheless holds the air of an extravagant talisman for someone who, just a few weeks previously, had endured wet feet after every rainfall because shoes are expensive.

Skeleton watches are notorious for their poor legibility. The actual hands of the watch can be hard to make out among the shimmering labyrinth of the gear train. As a result, the watch requires a moment of visual effort before the displayed time becomes apparent. This momentary pause, during which the temporal product remains obscured by its own mechanical construction, reminds me that the time shown on the watch is not a singular "essence" of time to be taken for granted but rather the intricately produced output of complex mathematical formulas and delicate physical components whose shapes and functions have undergone centuries of technical refinements. Only after this pause of recognition does the watch permit me to tell the time.

Every now and then, the way in which the skeleton watch proclaims rather than conceals the constructedness of its time allows my mind to linger more slowly on the

remarkable variety of cultural histories encapsulated within it. Blended together within any wristwatch are such diverse practices as those of ancient Egypt, where daylight was divided into hours using a base-12 counting system; Babylonia, whose use of a base-60 counting system in astronomy led eventually to the idea that an hour contains sixty minutes; medieval Europe, where the gradual development of mechanical clocks fostered the social importance of precise time measurement; the project of imperial colonization, which required the creation of miniaturized seafaring clocks that could withstand rolling motions and large variations in temperature and humidity; industrialization, which fostered the mass production of clocks as well as the precise conversion of time into profit; the First World War, where soldiers' need to check the time quickly without digging around for a pocket watch led to the masculinization of the fastening of timepieces onto the wrist; and, inevitably, contemporary consumer culture, in which manufacturers seek to make their watches impervious to weather, water, gravity, the decay of physical components over time, and the sensible management of personal finances.[3] As Kevin Birth observes, a clock "does not represent a coherent, consistent cultural system . . . but represents instead the sedimentation of generations of solutions to different temporal problems."[4]

These solutions have been implicated variously in violence and beauty, in technology and art, in shared identities and imposed conquests, in thoughtful negotiation with the natural world and in immense environmental destruction. In one way or another, whether we strap a watch to our wrist or tell the time through some other means, we are all implicated in the chain of cultural practices that have led

us to this moment. The skeleton watch provides one small glimpse into this series of connections. Even if it makes a person squint to tell the time, the skeleton watch provides another equally important kind of legibility.

Thomas Allen notes that a clock whose mechanism is laid bare renders "virtually transparent the entire process by which a scientific principle, the regular motion of the pendulum, translate[s] time from nature through a gear train into the hours and minutes of clock time."[5] This stands in opposition to a clock whose inner workings are concealed, which "renders the process of translation opaque," and whose displayed time appears to be "detached from nature and becomes a completed, self-contained product."[6] The distinction here is not that skeleton clocks are somehow "closer" to nature than enclosed clocks but rather that a skeleton clock draws attention to its own constructedness, making a point of the fact that its mechanism works incessantly to tread the ground between the natural forces of energy and momentum and the cultural construct of abstract mathematical time.

Don McKay uses the term *apparatus* to describe the sense of connectedness between a tool and its underpinnings in the natural material world, a sense that some tools embrace and that others conceal. "Whereas the meat-grinder wears its apparatus-nature," he writes, "the computer hides, and seeks to reside wholly in utility—*just* a tool, as it were."[7] He might as well be comparing a skeleton clock (the meat grinder of timepieces) to an enclosed clock like the ones on our walls and cell phone screens. Being a theorist of poetry, of course, McKay does not stop with the meat grinder observation but goes on to suggest that the tendency of many tools to

conceal their own apparatus-nature is a parallel to the way in which language likes to present itself as a simple representation of reality rather than as an unsteady contraption working to transform the raw material of the world into something culturally sanctioned for human consumption. In terms of the timepiece analogy, everyday language likes to pretend that it is a wall clock, just telling it like it is.

For McKay, metaphor is our best tool for cracking open the enclosed case of language to peek at the churning gears inside. The value of metaphor is that it declares and embraces its own reshaping of reality even as it enchants us with the imaginative leaps that are always necessary within language. When the poet Roy Kiyooka writes that "the moon / is a paper / lantern,"[8] his counter-logical language unabashedly teases our notion of mundane reality even while it speaks eloquently to, and indeed expands, the fundamental workings of the mind as a maker of metaphor, always drawing relationships between one thing and another. "This is what knowledge is," writes Jeffery Donaldson: "a vast network of relations."[9] For McKay, metaphor makes visible the fact that language, that purveyor of strange and necessary relations, has never been equivalent to the reality that it models. Ultimately, he argues, the ability to "think of language as apparatus, to use and inhabit it with an awareness of residual wilderness, is to be conscious of ourselves as translators of the world, wielders of a technology that remains visible."[10]

The watch, whether enclosed or laid bare, is an apparatus that constructs a new metaphor with every tick. The strike of the pallet lever *is* one-eighth of one second. The strike of the pallet lever *is* one-eighth of one second. Like the meat grinder, the skeleton watch makes visible the transformation of the

material world into products of human desire, drawing our minds toward the forms of power, discomfort, violence, and pleasure that are inherent in our complex and inequitable histories. Like metaphor, the skeleton watch enchants us by working beautifully at its task even while it calls our attention to the frailty of its translations. The mechanism appears always on the verge of breaking down, yet it ticks with perfection throughout the day and the night. When we hold the watch up to our eyes we reinforce our allegiance to cultural time even while dwelling on its hazards.

FALLEN TIME

Despite the beauty of the spinning balance wheel, the dangers of the cultural temporalities symbolized by the clock are diverse and frightening and, as we have seen, they have particular consequences for the natural world. Later in this chapter, stories about the symbolic power of watches will illuminate how these concerns unfold within domains such as corporate recklessness (in Thomas King's *The Back of the Turtle*) and the staggering immensity of deep time (in Don McKay's poem "Quartz Crystal"). First, I will consider how an inquiry into the threats that cultural time poses to natural time can culminate in the ability to perceive a wide variety of cultural objects as enclosed clocks, instruments whose mechanisms of time must be teased open.

When it comes to the critical study of time, scholars such as Barbara Adam have keenly observed the ecological hazards associated with modern or industrial time. Perhaps even more revealing, though, is the fact that studies that do not necessarily declare ecological concerns as a primary focus often tend to arrive sooner or later at the problem of

environmental sustainability. As I mentioned earlier, Jonathan Crary, in his book *24/7: Late Capitalism and the Ends of Sleep*, argues that the cultural world in which consumption, information processing, and labour occur endlessly throughout the day and night is the site of a momentous conflict between capitalism and sleep. Sleep, though, does not exist in isolation; it coexists with other forms of biological and ecological temporalities that are also placed at risk under contemporary capitalism. Crary highlights this trajectory when he declares that "24/7 is inseparable from environmental catastrophe in its declaration of permanent expenditure, of endless wastefulness for its sustenance, in its terminal disruption of the cycles and seasons on which ecological integrity depends."[11] As it seeks to monetize the gaze of our always-open eyes, the 24/7 society works to mask any awareness of the biological and ecological temporalities that it disrupts.

We can see a similar line of reasoning begin to emerge in the work of Hartmut Rosa, a German sociologist and leading scholar on social acceleration. He argues that the ongoing acceleration of many different social processes and events is not just a feature of modern society but is in fact the defining characteristic of modernity—that "*the experience of modernization is an experience of acceleration*."[12] His study systematically examines particular forms of acceleration within contemporary societies and everyday life. Only at the very end of this study, though, when Rosa contemplates where social acceleration might ultimately be leading us, does his conversation expand to consider the ecosphere. Arguing that social acceleration will probably lead us "into an abyss," he suggests that this abyss will be embodied in either "the

ultimate breakdown of the modern social order" or "the collapse of the ecosystem."[13] This point about the collapse of the ecosystem occurs on the last page of Rosa's book, as a kind of afterthought. On the one hand, the belatedness of this remark reflects the fact that the environment does not always take centre stage within discussions of modern culture and global capital, but at the same time it seems to imply a kind of inevitability in the logical sequence from contemplating the temporality of modernity to contemplating environmental disaster.

The pessimistic vision of cultural time as a harbinger of the destruction of nature is apparent in D.P. Brown's 1963 painting *Fallen Time*, which portrays a dead barn swallow hanging upside down against a decrepit wooden wall, its leg tied to a nail by a string. The painting is a crucifixion scene; the swallow hangs from the nail in such a way that its death becomes a public display. While Shakespeare writes that "True hope is swift, and flies with swallows' wings,"[14] Brown's splayed, lifeless swallow twists this association into a cruel irony. Any possibility of flight, song, breath, or hope has been destroyed, so that the death of the swallow is both the death of nature and of the creative spirit. Various other nails hammered haphazardly into the wood imply that this crucifixion has been carried out many times.

The title *Fallen Time* suggests that time itself has been tethered, killed, and put on display. The swallow becomes the pendulum of a wooden clock, hanging from the fulcrum of human time, its very body co-opted and forced to register a lifeless human-constructed temporality at the expense of its own. The title also suggests that, having performed such an act, humanity has fallen and, like Adam and Eve,

Figure 3-01: D.P. Brown. *Fallen Time.* Egg tempera on masonite, 23½" × 16", 1963. Collection of the Owens Art Gallery, Mount Allison University, Sackville, NB (Harper 397)

has doomed itself to an existence within a post-fall world. While the allusion to Christ potentially introduces some sense of hope for salvation, the swallow is all too present, too mortal, too dead. There is no indication of resurrection. Don McKay, after stumbling across a dead raven hung up at the roadside by a piece of baler twine around its leg, laments that the display of the dead bird is a way of "controlling its death as well as taking its life. Displaying it declares that the appropriation is total. A dead body seeks to rejoin the elements; this one is required to function as a sign, a human category—a sign which simply says 'we can do this.'"[15] If the skeleton watch makes visible the conversion of natural time into cultural time, Brown's swallow—itself a delicate skeleton in the making—bears witness to the darker consequences of this translation.

Barn swallows, as their name suggests, tend to make their homes in buildings constructed by humans, and their presence in barns is usually tolerated because of their usefulness in eating insects. Like the many temporalities of nature, the barn swallow does not represent some realm independent of culture but, like us, is a participant in the commingling of life within which nature and culture have never been separate. The crucifixion of the swallow, then, is the destruction of a mutual relationship, of a collective project of way-making within a shared world. It is an act that recalls the bleaching of the coral reefs, except that it is fully intentional. (Then again, this leads us to the uncomfortable thought that if we are fully aware that our actions are causing the bleaching of the reefs, then there is a sense in which this too is deliberate.) The close focus of *Fallen Time* forces our attention onto the vision of death, preventing

any sense of context or purpose, and this implies that there cannot be a justification for the destruction of nature's time. While Crary fears the voracious appetite of productivity and profit as they devour the natural cycles and seasons, *Fallen Time* represents a world in which there simply is no rationalization for the conversion of nature into the dead weight of the pendulum. The painting suggests that the destruction of natural time, whatever its reasons, is effectively blind to anything other than its own display.

WE'RE TAKING OUR TIME (BUT NOT WITH OIL PIPELINES)

As the mundane assortment of nails and wood in *Fallen Time* might suggest, our cultural encounters with natural time are shaped not just through watches and clocks but through all manner of material objects. We develop an ideology of ecological time whenever we gaze at a brightly lit phone screen after dusk or pick up a carton of orange juice imported from half a world away. The old cockney expression "queer as a clockwork orange" (from which the famous novella and film get their title) tells us that a mechanical fruit would be a very strange thing, yet there is a real sense in which an orange, whether you find it in a carton or on a tree, is an artifact that tells us how to relate to nature's time. An orange is always a clock, no springs or wheels necessary.

In fact, when we recall Michelle Bastian's definition of the clock as "*a device that signals change in order for its users to maintain an awareness of, and thus be able to coordinate themselves with, what is significant to them*,"[16] we soon find that *every* object is a clock. A plastic bottle signals the transformation of ancient hydrocarbons into a modern tool, which we use to satisfy our momentary thirst, and whose disposal will involve the

perpetual circulation of microplastics throughout the ecosystem and even within our own digestive tracts.[17] The plastic bottle signals the series of changes that constitute the Anthropocene. In its own way, just about any consumer product, and indeed anything whatsoever, ticks out a particular beat. A slice of cheddar cheese is a clock that signals the slow erosion of the caves at the village of Cheddar in Somerset, the evolving history of dairy farm agriculture, the maturing process for aging the cheese, the climate disruptions caused by methane from the cows, and the accelerative market forces of globalization. A coral polyp is a clock that signals—well, see the introduction to this book. By Bastian's definition, the only thing that stands in the way of our understanding every object as a clock is our own consciousness. As soon as we see the ballpoint pen or the shrink-wrapped cucumber as a signal of the temporality of plastic, it becomes a device that operates "in order for [us] to maintain an awareness." We might expand Bastian's definition by suggesting that every object, every action, every process, functions as a clock in waiting even if we don't notice it.

The fact that our orientation toward time is shaped not just through watches and clocks but through any object we might stumble across is a parallel to the way that our temporal imaginations are shaped not just through the elegant gearwheels of poetry but through the stories we encounter daily in such mundane places as advertisements and political news releases. An object doesn't need gearwheels to be a clock, and narratives are not just things we find in novels.

In considering the everyday "clocks"—both the objects and the narratives—that prove illuminating in thinking through the ecological hazards of cultural time, we would

do well to investigate such ordinary and dangerous things as the regulatory approval process for resource development projects. In Canada, we have been spending a lot of time arguing about oil pipelines, and it is vital to recognize the oil pipeline as both a cultural object and a site of contested narratives. The oil pipeline, after all, is a spectacular timepiece, turning one of the most ancient, slow-forming substances on earth into a stunningly rapid flow for fast economic muscle, and setting us on a long, long path into an alien future of collapsing climate systems.

The process that a society develops in order to approve or reject projects such as oil pipelines can be understood as a series of debates about what kind of time the oil pipeline will measure out and how this stacks up to the larger narratives of time that we choose to value. Discussions about energy projects involve a conflict between fast and slow, acceleration and caution, differently envisioned futures, and other unequal forms of temporal experience. Looking specifically at the matter of speeding up and slowing down, reading the oil pipeline reveals that fast and slow can each play the role of hero and villain in turn, and that a literacy of time is our only hope for telling the difference. Thinking about oil reveals the need for a critical literacy of time.

Slowness has become an infamous point of critical contention. The Slow Movement is praised for resisting the menace of social acceleration,[18] and it is criticized for its hopeless idealism and its blindness to systemic inequities. As I have mentioned, the practices of Slow Food are available primarily to the wealthy and are disproportionately inaccessible for those caught in the webs of economic and temporal poverty imposed most frequently on women and racialized

minorities. Sarah Sharma speaks of the need to recognize "the temporal labor and temporal architectures that make slowness desirable and possible for some but not for others."[19] Hartmut Rosa, meanwhile, argues in much broader terms that any attempt to slow down in the modern world is essentially doomed for a number of terrifying reasons.[20]

Perhaps the best-known recent ecocritical study of slowness is Rob Nixon's book *Slow Violence and the Environmentalism of the Poor.* "By slow violence," he writes, "I mean a violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all."[21] Many of us in the environmental humanities have been inspired and vexed by his important question: "How can we convert into image and narrative the disasters that are slow moving and long in the making, disasters that are anonymous and that star nobody . . . ?"[22] Nixon's call to highlight slow disasters and slow crimes offers a potent approach for critical readings of certain problems. In terms of petroleum, his work can help us read oil extraction projects and pipelines as triggers for the long, slow violence of climate change as well as the slow and always-incomplete recovery process set in motion by oil spills, a process that has barely begun by the time the news media, or their public, loses interest. As Nixon writes in reference to the Deepwater Horizon oil spill, "the time frames of damage assessment and potential recovery are wildly out of sync."[23]

The trouble with slowness that I wish to emphasize here, though, is somewhat different. A critical attention to temporal power reveals that slowness alone will not save us (as the Slow Movement might hope) and neither will it function

only to doom us through invisible long-term disasters (as in slow violence). When acceleration is tied to unsustainable practices, as with oil pipelines, slowness can indeed mitigate harms by emphasizing diligence and caution, but it can also be deployed as a tactic of profitable destruction. Careful temporal literacy is required in order to discern the shifting forms of power in which speed and slowness are embroiled.

Various pipeline projects have had their turn in the spotlight—the Trans Mountain pipeline representing a particularly vicious recent dispute—but the example I want to focus on here is a decision made by Canada's federal government a number of years ago that remains instructive for thinking through the ways in which similar moments recur again and again. In 2012 the federal government decided to shorten the maximum period of time for the environmental review of major resource projects. Previously, such environmental reviews were allowed to take up to six years; after the policy change, the time limit became two years. This decision was tied most obviously to the review of Enbridge's Northern Gateway oil pipeline, a proposed pipeline system for transporting bitumen substances from Alberta to coastal ports in British Columbia, from which oil tankers would then gain access to Asian markets. Canada, Prime Minister Stephen Harper had previously declared, was now an "energy superpower."[24]

The compression of environmental reviews from six years to two years was a welcome temporal shortcut for Enbridge spokesman Paul Stanway, who warned that "there is demand for both gas and oil in the far east. The clock is ticking, though."[25] His language jibes with that of then Finance Minister Jim Flaherty, who commented that economic growth is

"going to come from innovation, it's going to come from an accelerated regulatory system."[26] In the ideology of fast profit there is *no time* for lengthy environmental assessments. This policy approach privileges the ticking clock of corporate profit and disregards the ticking clocks of ecosystem collapse and climate disaster. The clock metaphor is strategically applied in order to define, not just measure, what is most significant. One might contrast Enbridge's ticking clock metaphor with the more recent use of the image of an hourglass in the Extinction Rebellion symbol to represent how the remaining time to mitigate climate catastrophe is running out.

Meanwhile, beyond the belief that development must occur rapidly, additional forms of temporal power are at stake. The shorter environmental review timelines applied not only to future reviews but also retroactively to reviews already underway. For the Enbridge proposal this meant that the rules were changed mid-game and that various reasons to be cautious about the pipeline project may not have had time to come to light; moreover, it meant that Fisheries and Oceans Canada (itself the target of simultaneous massive budget cuts) simply would not have time to complete the necessary risk assessments for the nearly one thousand streams and rivers in the pipeline's path.[27] The imposition of acceleration as well as the ability to retroactively apply new temporal edicts operate clearly here as tools of political power.

Significantly, when the conversation shifts from the green-lighting function of these environmental "assessments" to the establishment of actual environmental *regulations*, the above emphasis on speed and acceleration disappears, giving way to pleas for slowness and precaution. When the Government of Alberta proposed a carbon-pricing scheme that "could

cost industry up to 94 cents per barrel," the Canadian Association of Petroleum Producers wrote that "major policies like this one should not be fast-tracked. Adequate time is required for study analysis and consultation."[28] This statement is a classic example of what writer Alex Steffen calls "predatory delay," the tendency of the powerful to argue "against needed action in the name of prudence or process or tradition."[29] The lobbying was quite successful, and even the federal government, which was also involved in the discussions, delayed the release of draft regulations. Once again the government's language closely mirrored that of the industry, with then federal Environment Minister Leona Aglukkaq's spokesperson saying, "Our government is working with the provinces and stakeholders to develop these regulations. We're taking our time and they'll be ready when they're ready."[30] Citizens who might want to mitigate the climate crisis are not meant to notice that delayed regulations do not regulate, and that a fast review is not so much an assessment as an endorsement.[31]

	INDUSTRY	GOVERNMENT
On speeding up environmental assessments	"There is demand for both gas and oil in the far east. The clock is ticking, though."	Economic growth is "going to come from innovation, it's going to come from an accelerated regulatory system."
On slowing down environmental regulations	"Major policies like this one should not be fast-tracked. Adequate time is required for study analysis and consultation."	"Our government is working with the provinces and stakeholders to develop these regulations. We're taking our time and they'll be ready when they're ready."

The potential consequences of such events may be profound, but to the extent that they exemplify the use of time as a form of power they are entirely commonplace. Consider the similar temporal manoeuvres that were at stake in a policy on Indigenous consultation created by the Alberta government in 2013. *The Globe and Mail* observed that in spelling out the rules for how the resource industry should consult with First Nations, the policy mandated that a government office would "set standards for when consultation is required and how much is enough" and that any consultations would take place after (not before) companies have been granted leases for exploratory work.[32] Eriel Deranger of the Athabasca Chipewyan First Nation also pointed out that the consultation timelines established by the policy were "likely to be too tight for small bands struggling to cope with massive industrial development."[33] The manipulation of sequence, timing, duration, rush, and delay are among the typical strategies that have sullied the word *consultation* in the context of colonization. Appropriately enough, the government released this policy on a Friday afternoon, bypassing the weekday timing when the story might have gained more traction within the news media cycle.

Such processes play out in specific ways within Canadian society, but the general use of temporal power is not tied to any individual nation. Political scientists Tony Porter and Liam Stockdale have identified how processes tied to "the strategic manipulation of temporalities . . . help constitute globalization."[34] They point, for example, to "the manipulation of expectations about the future . . . [in] the global derivatives market"[35] as well as "the ability of powerful corporations to construct and manipulate the temporalities of

transnational production."[36] Any number of events show us that actors at all scales, from the multinational to the interpersonal, routinely manipulate time for political advantage.

Ultimately, stories about oil pipelines and other global and local projects are less about fast versus slow than they are about time as power, and these examples reveal that the question of who gets to tell the time often determines which vision of the clock will dominate. The Trans Mountain pipeline has been an amazingly volatile example of competing narratives of time; when the project's owner, Kinder Morgan, grew exasperated in 2018 with ongoing regulatory delays, Canada's federal government announced that it would buy the pipeline outright for $4.5 billion to ensure its completion, only to then have construction halted again by the Federal Court of Appeal because of inadequate Indigenous consultation and overly limited environmental assessments.[37] One can imagine a pendulum swinging between what might be called "combustion time" (in the sense of burning fossil fuels and of accelerating global heat) and the urgent timeline of climate crisis mitigation.[38] In my part of the world, a lot of people depend on oil to make their living; it is not exactly fair to ask them to shoulder the blame for the entrenchment of combustion time, and the frustration that arises when a pipeline faces yet another delay is very real and deserves compassion. The need to cut greenhouse gases is a central reason for opposition to pipelines, and we should remember what this means: the people who are at risk of losing their jobs around the fossil fuel industry are among the victims of climate change. Ironically, by speeding through the consultations and delaying the enforcement of environmental regulations, proponents of oil pipelines have often, in turn,

seen their own projects held up by endless delays as these failures work their laborious way through the courts.

The urgency of climate crisis mitigation also holds compassion at its centre; among those who emblematize this perspective is Rita Wong, a poet and professor from Vancouver, who was arrested along with a number of other land protectors for blocking access to the Trans Mountain pipeline's terminus on the West Coast. In her statement upon being sentenced to twenty-eight days in prison, she explained, "We waited patiently for decades before determining—at a moment in history when time has almost run out to act—that orthodox ways of getting the federal government to act were doomed to fail."[39] Wong served her time just as construction work was ramping up on the once again re-approved pipeline. A delay of the pipeline is a delay of the paycheck, but it is also, just maybe, a potential delay of ecosystem collapse and an opportunity to make progress on Indigenous reconciliation. Which of these clocks will tell us the time?[40]

When it comes to a literacy of time, the key is that the mobilization of entrenched temporal power takes shifting forms. Yes, it privileges the fast profits of global corporations at the expense of the long-term health and security of those who face the consequences of rapid development, and yes, it obscures the slower and more sustained forms of inquiry that are necessary even to begin to account for the multiple nonlinear temporalities of ecosystems. Perhaps even more insidiously, though, the mobilization of temporal power allows those in positions of privilege to initiate arbitrary temporal rules—deadlines, timelines, time limits, strategic manipulations of speed, delay, and sequence—and

to change these temporal rules at will. In the face of such temporal inequities, a rigorous and politically aware form of ecocritical time studies founded on temporal literacy is necessary to work effectively toward the implementation of environmental, social, and temporal justice. Environmentalism must be concerned with the temporalities of ecosystems and with the social politics of time, with the clocks of objects and the clocks of narratives, and it must mobilize its own temporal vision. We must understand how to read the ideas of fast and slow not as intrinsically good or bad but as forms of power that operate within a much larger toolkit of devices of time.

WHAT IF SOMEONE GAVE YOU A ROLEX?

I opened this chapter with a meditation on an actual watch, which expanded into a method for telling the time by considering *any* object as a clock, an interpretive process that is particularly important when the object (such as an oil pipeline) is entwined in many contested narratives. The final stages of this chapter now return to fiction and poetry in order to consider once again the role of literature, not in advocating for one particular narrative of the clock but in teaching us to read all manner of clocks, literal and symbolic, with thoughtful attention to the politics of time.

Thomas King's 2014 novel *The Back of the Turtle* considers ecological destruction, the dangers of for-profit genetic engineering, and the problems of accountability within corporations, governments, and societies in the era of petroleum. The novel uses King's usual techniques of irony and satire to develop a particular interest in the matter of ecological responsibility, largely through the character of Dorian

Asher, the CEO of Domidion, a Toronto-based corporation involved in a number of problematic industries including GMO agriculture, bottled water, and extraction of the Alberta oil sands. For my purposes here, a particularly illuminating element of the novel is that it asks us to understand the problem of unsustainability as a matter of temporal power, a form of agency that is in some ways universal but also slippery and unjust, and which often remains hidden. Like the pipeline approval processes discussed above, the corporate activity in the novel can prime us to cast a critical eye on the manipulation of time. More than the real-life policy, though, the novel heightens the development of a temporal literacy through the lens of irony, and it suggests how the figurative links of imagery—specifically, the image of the wristwatch—can prompt scrutiny into the everyday emblems of temporal power.

Dorian serves largely as a personification of, and satire on, corporate amorality. He is a clownish figure whose guiding principles are limited to ensuring profitability and managing the stock price of his corporation, even while the disgraceful actions of his company destroy entire ecosystems and countless lives. His company has been filling its oil sands tailings ponds too quickly, not allowing time for evaporation, and this insistence on speed has resulted in the catastrophic breach of a dam.[41] As Peter Mansbridge reports on the CBC, the dam has "dumped thousands of gallons of toxic sludge into the Athabasca River."[42] Dorian's assistant quietly informs him that, with a spill larger than the Deepwater Horizon disaster, the toxic waste "will kill everything in the river" and then "wind up in the Beaufort Sea."[43]

Domidion quickly puts into action its "emergency protocols" and "Rapid Response Team," whose purpose, in King's sardonic fashion, is to obscure the source of the spill and to keep the media away from the site.[44] The plan of rapid action is a rush to accomplish nothing except for the careful management of media spin. Meanwhile, people who live along the Athabasca River are dying from the toxins. "Fortunately," a PR representative explains to Dorian, "most of these are Native communities where the mortality rate is already higher than the norm. . . . Making it difficult to determine whether the additional deaths are the result of the spill or lifestyle."[45] The immense power that Dorian holds in his management of Domidion results in rapid mass death, while the victims of the crime belong to a marginalized group whose suffering is easily dismissed on the national stage. The cynicism of these scenes makes for a bitter satire on corporate responsibility, the miserable failure of safety regulations, the magnitude of environmental racism in Canada, and the routine manipulation of the news media. Alongside these disasters is the company's secretive development of a bacterium called GreenSweep, a herbicide that works like a pumped-up version of Agent Orange.[46] The use of concentrated GreenSweep near the coast of British Columbia, intended as a "shortcut" for clearing the undergrowth for a pipeline installation, has resulted in the complete death of the local forest and river system and has created a twenty-kilometre kill zone in the ocean.[47]

While Dorian appears immune to any ethical consideration of his leadership, he suffers from a variety of troubling maladies, including tremors, sweating, dizziness, and, most worrying of all, increasingly "vivid metaphors."[48] He believes

he is dying of a brain disease, a fear that is compounded when his doctor tells him to undergo an MRI scan, which uses a magnetic field to reveal the body's internal tissue.[49] In an effort to regain a sense of mastery and calm, Dorian visits a luxury watch retailer in Toronto and purchases what, for him, is a relatively inexpensive piece, a Rolex Milgauss worth around $10,000:

> Along with the Brioni tie, he had found a pair of Ferragamo shoes, a couple of Eton shirts, a bottle of cologne, and a Rolex Milgauss. The Glace Verte model with its distinctive green-tinted sapphire crystal, orange lightning-bolt second hand, and black face. In the world of fine watches, the Rolex wasn't an expensive piece. A Jaeger or a Patek would have made a larger dent in his expense account—and he had seen a very nice Jaeger—but he liked the casual look of the Milgauss.[50]

The second hand of the Milgauss, which takes the shape of a lightning bolt, looks powerful and ominous, while the watch's colour scheme of orange, green, and black calls to mind GreenSweep, Agent Orange, and the blackness of death. The claim to fame of Rolex's actual Milgauss model is that it is shielded to protect the mechanism from magnetic fields, a particular draw for Dorian, we might suspect, given his anxiety about his upcoming MRI; the watch almost seems intended to shield him from his fears, even while its orange lightning bolt appears to celebrate the destructive power that he wields over the masses like a modern-day corporate Zeus.

King's detailed description of the watch grants the object a symbolic power, especially when read alongside the many forms of temporal domination that exist throughout the narrative. Ecological destruction, in this novel, is a problem of time running out. Corporations, government, the media, and individuals all bear responsibility in negotiating the difficult temporalities of sustainability, ecological retribution, profit-making, distraction, and excuse-making, yet certain hands (or, symbolically, wrists) hold much more temporal power than others. Domidion exercises control over the speed of industrial development, the delaying of accountability, and the very pace of "progress" along with its increasingly rapid catastrophes—forms of temporal power which, for Dorian, are matters of routine. And yet, he remains haunted by those aspects of time, mortality in particular, that exist beyond his control.

Most people could never dream of owning a Rolex, but for Dorian the watch is an impulse, reflecting his position of authority and his "casual" ability to exercise control over time. Simultaneously, though, the purchase is a desperate act, an attempt to assuage his fears through the luxuries of high-end consumer culture, implying a sense of inadequacy in his need to affirm his position of power as a wealthy corporate executive. Somewhat unsurprisingly, then, the watch and the clothing do not satisfy him:

> He had taken his time with each purchase, allowing the salespeople to confirm the value of quality and the pleasures of status. But none of it had cheered him. Twelve thousand dollars, and he was still depressed.

Maybe he hadn't spent enough.[51]

Sure enough, Dorian returns to the jewellery shop near the end of the novel, this time spending around $24,000 on a watch that had previously caught his eye: the Jaeger Reverso "with reversing black and white etched faces."[52] The real-life version of this model indeed has two displays, one of which is always concealed. In practical terms, this means that business travellers can set each face to a different time zone. In more figurative terms, the watch emblematizes the two-facedness of Dorian himself. Implicit in Dorian's removal of the Rolex from his wrist in favour of the Jaeger[53] is the notion that he prefers the watch that celebrates his own deceitful nature. Or, the two faces correspond to Dorian's divided status as powerful and powerless, as the divine being who hurls death with impunity and the neurology patient who fears for his own life, as the tycoon who chooses which expression of progress will prevail at any given moment and the environmental laggard taken aback by the speed of disaster, as the corporate executive who subjects others to toxins and the customer whose new mattress releases a chemical smell that gives him headaches and a sore throat.[54] Temporal power is concentrated in the hands of the few, but it is never absolute.

In one of the final scenes in the novel, Dorian shows off his new Jaeger to his driver, Kip, and asks Kip what kind of watch he wears himself. Kip explains that he wears "a dependable watch. . . . Very inexpensive. Very accurate. It runs on solar energy. No winding. No batteries."[55] Dorian then asks Kip, "What if someone gave you a Rolex?"[56] Kip laughs in response, and Dorian does not give him the

watch. By showing off his luxury watches, Dorian makes visible the immense power and wealth that he holds over his driver. The startling idea that he might make a spontaneous gift of the Rolex, an object so out of reach for Kip that he can only laugh, raises the possibility of Dorian freely sharing his power, yet the scene also emphasizes that only Dorian is in the position to decide who will wear the temporal emblem. Of course, the entire exercise becomes a rather cruel exhibition when Dorian declines to hand over the Milgauss. Kip's humble watch, meanwhile, has no pretensions aside from the fact that it runs rather pointedly on solar power; even the lowly car driver, who must chauffeur the Domidion CEO around town in a conspicuous combustion vehicle, wears his own modest form of temporal agency through which he can perform a minor act of environmentalism. Kip's watch pales in comparison with Dorian's, yet it also slightly threatens Dorian's power by embodying an alternative register of value.

At the end of the novel, life starts to return to the sea; urchins, crabs, starfish, otters, gulls, sandpipers, and ravens reappear on the coast, followed by newly hatching turtles.[57] The ecological time, then, that the novel finally envisions is one that remains resilient and cyclical despite the rampancy of corporate annihilation. The hopeful ending is faintly shadowed, perhaps, by the fact that Dorian still sports his two-faced timepiece, yet the emphasis on ecological recovery in the concluding scene—the revelation that "the ocean had come back"[58]—reveals a continuing investment in the idea that nature will always return to its familiar state of supposed balance. The rebirth of new life makes for a good story. Such a narrative sits uneasily, though, with

the reality that oil spills, industrial disasters, and climate instability do not merely nudge nature momentarily out of equilibrium but rather more fundamentally reshape the ecosystems in which they exist. *The Back of the Turtle* satirizes the sociopathic corporate denial of ecological responsibility as expressed through temporal power, yet it also partly reaffirms the assumptions of cyclical ecological resilience that seem to excuse environmental destruction in the first place. Like so many of our attempts to interrogate the links between culture and nature, this narrative develops a critique that is both useful and incomplete.

DESTROYING THE WATCH

The skeleton watch is a metaphor machine, endlessly writing a poem composed of one repeating line: the strike of the pallet lever *is* one-eighth of one second. Even the famous rhythm of iambic pentameter, which keeps a steady beat but inevitably brings about variations and inversions, has got nothing on the uniform pulse of the balance wheel. Nevertheless, the forms of poetry composed of the rickety apparatus of language do have something to offer as we consider the artifacts that confront natural and cultural time. The messiness of a poem, its insistence on playing with, rather than conforming to, the rhythms of our cultural clocks, fosters particularly imaginative possibilities. Some theorizations of time, such as Rosa's and Crary's explanations of the inescapable dangers of modernity and neoliberalism, seem to result in a near-hopeless assessment, leaving little room for creative promise. Poems, though, help us bear witness to, and perhaps peek beyond, the constructedness of cultural time.

Don McKay's work has made a number of appearances in this book because his essays shine a thoughtful light on such notions as metaphor and memory. McKay is also a poet in his own right, and his poem "Quartz Crystal" says more than many essays could do about how an everyday encounter can bring about a radical temporal shift. As an object poem—a poem that reveals something unexpected about an inanimate object—"Quartz Crystal" carries out a deliberate reorientation of the human place within the broad expanse of natural time.

Looking at a quartz crystal that "rests among the other stones on my desk," the poet picks up the "perilously perfect" object and contemplates its incredible origins within the recesses of deep time.[59] The overwhelming longevity of the crystal throws his own brief existence into precarious relief and calls for an immediate, even panicked, response:

> Who do I think I am, with my little dish of stones, my ballpoint pen, my shelf of books full of notions, that I should own this specimen of earth's own artifice, this form before mind or math, its axes reaching back to the Proterozoic, its transparence the Zen before all Zen? It becomes clear that I must destroy my watch, that false professor of time, and free its tiny slave.[60]

Inevitably, perhaps, the poet's attention shifts here to the much smaller quartz crystal—the "slave"—nestled within the heart of his wristwatch.

The skeleton watch that I have described in this chapter is a mechanical watch composed of moving parts driven by a spring, but the vast majority of watches sold in the

past forty years, including the one that McKay suddenly regards with suspicion, are quartz crystal watches driven by a battery. Where the mechanical watch measures time through the swinging motion of the balance wheel, a quartz watch sends an electric impulse through a minute quartz crystal that has been cut into the shape of a tuning fork. The resulting throbs of the crystal occur at an astonishingly constant rate, which the watch then converts electronically into the pacing of the second hand. Never mind that quartz watches typically use synthetic crystals; for McKay's poet, the enslavement of the geometric mineral seems unconscionable given its ancient crystalline form.

The slave in question, however, is not only the crystal that serves as the oscillator within the wristwatch but also the poet himself, who, like so many of us, endlessly organizes his daily life around merciless, seemingly totalizing clock time. The watch is a false timekeeper because it is incapable of articulating the staggering temporality of rock, and because its vision of absolutely regular homogeneous time is blind to the subjective qualities of temporal experience, including the sudden temporal shock that causes the poet to gawk in defamiliarized astonishment at the mundane objects around him. In light of this failure, he destroys the timepiece. This act, however, is unfulfilling, and seems somehow incomplete:

> No problem—a few taps with a piece of Leech River schist and the deed is done. But more is required. What? Off with my clothes; how else but naked should we approach the first of symmetries? Still insufficient . . .

> What next? Unfortunately, it appears I must set aside
> my fingers and thumbs, those tricky manipulators who
> have so busily converted rock to stone, who perpetrated
> the pyramids and silicon valley: go clasp yourselves in
> the dark until you learn to sit still and attend. More?
>
> I give up baseball, with its derivative threes
> and dreams of diamond.
> I forswear the elegant pairs and numbered runs
> of minuet and cribbage.
> I renounce the fugue. Dialectic,
> I bid you adieu. And you,
> my little poems, don't imagine I can't hear you
> plotting under your covers, hoping to avoid
> your imminent depublication.[61]

Our physical manipulation of the earth, as well as the less tangible forms of inspiration we take from natural processes, are encapsulated within the figure of the watch, which houses the appropriated crystal along with the cultural model of "objective" daily time reckoning. But while the task of rectifying or acknowledging the human appropriation of the earth's material begins with the destruction of the watch, the project quickly reveals itself to be the unfinishable task of complete self-erasure; everything that we take for granted in our cultural world is younger than, and in a sense owes its existence to, the crystal. Technological and cultural innovations always mark various forms of time; a fugue follows the time signature of its melody, clothing is tied socially to temporal patterns of fashion trends as well as to the long pacing of social evolution, Egyptian pyramids

serve as habitats for eternity, while poems themselves form patterns of pace, rhythm, and temporal thought.[62] Each of these clocks is as guilty of charlatanism as the watch when it comes to articulating the deep past and paying homage to the priority of the ancient earth. Thomas Allen, drawing from Henry David Thoreau, notes that there is a "profound critique of human agency contained within the concept of deep time."[63] And yet, human agency is all we have. McKay's train of thought indicates that to destroy the watch and everything it represents would be to destroy himself—"and you," as per the pointed line break.

The final sentence of the poem (or rather, quite appropriately, a sentence fragment) says nothing more about the renunciation of human technology and culture but embodies a reflective awareness that can serve as one possible response to the watch's narrow view of our existence in time: "While the crystal floats like a lotus on my palm, bending the light from a dying star to dance upon my coffee cup this fine bright Cenozoic morning."[64] In Homer's *Odyssey*, the mythological lotus induces a dreamy, almost timeless, forgetfulness. The flower, Homer tells us, is "so delicious that those who ate of it left off caring about home, and did not even want to go back and say what had happened to them, but were for staying and munching lotus with the Lotus-eaters without thinking further of their return."[65] In McKay's poem, the lotus-like crystal causes the poet to forget his earlier preoccupation with the disassembly of pyramids and baseball, and to sit, mesmerized, within an expansive view of his cosmic cohabitation with the crystal. He even forgets to add an independent clause to his final fragment of thought—yet this fragment itself, in

content and form, communicates what has happened to him. The fragment zooms out from the crystal on his palm to an immense view of space and our solar system, then immediately back in to a close-up of the coffee cup. Finally, this dizzying spatial leap is repeated in temporal terms with the final two words: *Cenozoic*, which encompasses the period of time from the decline of the dinosaurs to the present, and *morning*, the human-scale moment in which the poet sits in his office.[66]

The vertigo of these staggering juxtapositions serves as McKay's final response to the quartz crystal, suggesting that contemplation of the human place within vast expanses of space and time is itself a form of homage to the earthly matter on which our existence depends and is a more appropriate project than the renunciation of human creativity. The lotus-like crystal removes the poet from his everyday temporality and takes away his desire to return to the "home" of his prior consciousness. Or rather, this expanded temporal consciousness becomes his new home, one in which we, too, linger as we read the final fragment of the poem. As Travis V. Mason observes, McKay's geopoetry "pursues a humble attention to physical forces bigger and older than humanity, albeit ones that humans are affected by and complicit in."[67] This broadened form of awareness connects mundane time with deep time; it is a temporal perspective broad enough to see the sun as a slowly dying star, yet one that remains tuned to immediate thoughts and actions, prompting questions about the temporal implications of a cup of coffee.

In more general terms, we might say that the form of poetry tends to encourage this type of reflection. In the way that poetry requires multiple readings and the articulation

of complex connections, it revels in the slowness of interaction, teaching patience as well as alertness and requiring readers to cast their eyes back as well as forward. In a world of social acceleration, poetry puts on the brakes. And even while it slows us down, it questions slowness, speeding us up into new forms of action much like McKay smashing his watch with a rock. Poetry asks us to construct a new home of temporal consciousness, and it implicitly questions familiar visions of progress, pacing, productivity, linearity, and narrow temporal frames. "Quartz Crystal" tells us that we cannot destroy the watch without destroying ourselves, but that we can reset the scale of our temporal ideologies and perceptions to better accommodate a more-than-human perspective on the world.

If the domestication of time involves bringing natural temporalities into the house of human culture, shaping them in alignment with particular human ideologies and priorities, there must also be a process by which human time becomes wild time, a process of forgetting or denarrativizing our usual temporal modes. This process occurs whenever time risks escaping the ticking digits, ordered calendars, ideological constructions, and other human-scale reference systems by which we attempt to categorize it. Any old narrative can serve to domesticate time, to construct a cultural model in which time takes on a certain form. Thoughtful works of literature do this as well, but they can also twist the process around by cracking open the case of cultural time, revealing that culture's clocks have always been fragmented, partial, and ideological. By breaking open the clocks of cultural time, literature, just maybe, can escape from them, creating a more nuanced and humble perspective on the

environmental processes on which humans depend. If the skeleton watch is a poem that declares the fragility of its own apparatus, the poem is a clock that expands our consciousness beyond cultural time.

THE RECREATIONAL VEHICLE

THE PROBLEM OF UNSCHEDULING

One of the treacherous themes that occurs across many cultural texts, from biscuit packages to certain works of literature, is the notion that nature is a place where time slows down, where the acceleration society does not intrude, where time maybe even stops, or perhaps never really existed at all. In this vision, nature's time belongs to the past. It is enclosed in the realm of fantasy or irrelevance where it can be safely depoliticized. This fourth chapter is about the need to identify and challenge such representations of nature's time as slow, frozen, or empty.

If we are going to travel down the road of examining a diverse collection of cultural texts as implements of temporal ideology, we would be remiss not to say something about the world of advertising. Commercials from oil companies,

for instance, masterfully deploy the rhetoric of petrocultural time, using elegant animations to legitimize the need for action that is faster than informed thought, or playing slow tranquil music to mask the rush of extraction.[1] Rather than focusing too much on one industry, though, in this section I will look at a delightful and perilous camping ad about slowing down and getting back to nature.

"Unscheduled" is the name of an advertisement produced for Go RVing Canada, which has aired on television as well as online through YouTube.[2] Go RVing is a coalition of recreational vehicle (RV) manufacturers and dealers as well as campground organizations. The purpose of the organization is to promote RV travel, and it does so in this ad through a series of time-based associations.

The 55-second ad begins with the members of a suburban white middle-class family scrambling in their laundry room, kitchen, and two-car driveway to catch up to the scheduling demands of their day. The series of shots within this first part of the ad is fast-paced, with frequent cuts between shaky, poorly framed camera angles that create the impression that the footage was shot in the same frantic pace experienced by the family and that handheld cameras were necessary because the events happened in too much of a rush to allow for more carefully orchestrated cinematography.

The dialogue between the mother, father, and their four children is so hectic as to be largely unintelligible. "You're going to pick up Chelsea from ballet at seven thirty," the mother says rapidly to her husband (who is checking his phone and consulting a note stuck on the fridge in the kitchen) while she pulls socks onto her daughter's feet in the laundry room. The husband points out that picking

Figure 4–01: "Unscheduled" 1 (Go RVing Canada)

up Chelsea will create a scheduling conflict, and the rapid dialogue descends into a series of panicked interruptions, all spoken while the parents try to corral their boisterous children into the vehicles in the driveway. References are made to guitar lessons, martial arts lessons, math tutoring, and a school play, all while the various family members make and partially consume sandwiches ("Just shove it in your mouth, let's go," the father says), put on various clothes, find lost keys, break up a fight between at least two of the children, confirm addresses and appointment times, determine which family members must be present in each of the two vehicles in order to orchestrate the appointment pickups that will occur later in the day, and finally determine who will actually *fit* into each vehicle, causing a panic and a complete switch of both vehicles' occupants when the tail of Jack's dinosaur costume for the school play will not fit into the smaller car. Twenty-eight seconds have now elapsed.

At this moment, the calmly singing voices of a second family become audible, and the first family stops, mid-panic,

Figure 4–02: "Unscheduled" 2 (Go RVing Canada)

to watch as a recreational vehicle coasts by at an entirely relaxed pace, while the occupants sing the French-Canadian children's song "Alouette." Slow smiles break across the faces of the first family as they gaze upon the RV, and a calming piano composition begins to play, drowning out the sounds of the suburban street.

The shot fades to black, and then it fades back in to the first family now seated around a secluded campfire at night, an RV framed prominently behind them. The family members are roasting wieners on sticks, playing guitar, and holding one another around the fire. The perfect clarity of the soothing piano music is accompanied by the barely audible lapping of gentle waves at the shore of a lake. A final shot appears, in which the camera has pulled back to show the campfire and the RV nestled beneath a large tree alongside the serene waters. The darkness of this nighttime shot contrasts the pure white word that fades into the centre of the screen—"Unschedule"—which finally gives way to the web address GoRVing.ca.

Several important factors are at work in this ad. We see, most starkly, that human culture is *fast*—fast to the point of chaos, panic, pointlessness, and perpetual anxiety. Founded on what David Landes calls "time discipline"—the internalized drive to be punctual that is tied to the ubiquitous presence of clocks[3]—modern culture in this ad is driven by speed, complexity, deadlines, schedules, and multitasking, and as a civilizational strategy it risks being self-defeating.

Nature, on the other hand, is slow. It is a place where the demands of scheduling and social acceleration have been lifted, leaving behind a pure experience of recreation, clarity, and communal gathering. The ad is selling RVs and camping by linking them conceptually with what some sociologists of time refer to as "event time," a cultural approach to time in which events transpire at their own usually relaxed pace, as opposed to a faster and more rigid clock-based time. As social psychologist Robert Levine concludes in his cross-cultural analysis of the pace of life, "One of the most significant differences in the pace of life is whether people use the hour on the clock to schedule the beginning and ending of activities, or whether the activities are allowed to transpire according to their own spontaneous schedule. These two approaches are known, respectively, as living by clock time and living by event time."[4]

Those societies that primarily emphasize event time (typically in less industrialized nations) experience both the benefits and the costs of their temporal socialization. Levine points to survey data that indicates that people in "slower" event-time–driven places are much less likely to die from heart disease but are also less likely "to be satisfied with their lives."[5] However, for the fast-paced clock-driven societies of

late modernity, the demands of accelerative scheduling and multitasking mean that event time is rarely practised in any sustained way. Because its complex realities are largely unfamiliar to members of late modernity, event time can therefore be represented in an idealized form as a "natural" pre-existing state of temporal perfection, the antidote to the accelerative anxieties of everyday life.

Indeed, the use of event time as a marketing strategy in the Go RVing ad closely echoes the similar use of event time in the well-known series of tourism advertisements run in recent years by Newfoundland and Labrador Tourism. Playing on the unique time zone that the province inhabits within the global standard time system, these ads characterize the region as a sanctuary from the time pressures of modern life. One such ad features slow-motion footage of people engaged in leisure activities—hiking, throwing stones into the water, playing music, buying a cake—while a soothing voice says, "When you're always a half-hour ahead, you never feel the need to catch up."[6] The provincial tourism agency elaborates, "We've never been afraid to be ourselves or go at our own pace. And we don't really measure time in seconds or half hours, but in moments and experiences. Here, you can set your watch a half hour ahead, or you can just leave it at home."[7]

This fetishization of event time is echoed not only in the "Unschedule" tagline of the Go RVing ad but also on the Go RVing website, which asks, "Have you ever returned home from a holiday and felt like you needed a vacation from your vacation? That's what happens when you're stuck following someone else's timeline. . . . A vacation in your RV comes with a blank itinerary. Life happens on your time."[8]

If the accelerative time discipline of late modernity is the disease, then event time, as sold through tourism and recreation agencies, especially those that emphasize enjoyment of the natural environment, is the cure. However, this representation of slow nature as the antidote to fast culture is problematic in several important ways.

A conventional ecocritical reading of the Go RVing ad would likely borrow from William Cronon's well-known observations about the paradoxes and forms of denial that are built into the romanticized vision of wilderness as a place to which we can "return" in order to seek refuge from civilization:

> To the extent that we live in an urban-industrial civilization but at the same time pretend to ourselves that our real home is in the wilderness, to just that extent we give ourselves permission to evade responsibility for the lives we actually lead. We inhabit civilization while holding some part of ourselves—what we imagine to be the most precious part—aloof from its entanglements. We work our nine-to-five jobs in its institutions, we eat its food, we drive its cars (not least to reach the wilderness), we benefit from the intricate and all too invisible networks with which it shelters us, all the while pretending that these things are not an essential part of who we are. By imagining that our true home is in the wilderness, we forgive ourselves the homes we actually inhabit.[9]

Cronon perhaps overstates the degree to which urbanites might disown the "entanglements" of modern culture. Still, representations of nature such as those in "Unscheduled" clearly confirm his central observation. In subscribing to the vision of wilderness travel as either a form of refuge or a return home, we risk failing to address the problem of how we might build sustainable practices into everyday life. This conceptual problem that Cronon identified twenty-five years ago remains with us, and his insights can still shed light on contemporary representations of culture and the environment. In temporal terms, the Go RVing ad tells us that the more frenetic elements of the acceleration society—the problems tied to overwork, multitasking, urban sprawl, consumer culture, even scheduling itself—no longer need to be addressed once we have rented a campground.

Interestingly, when we shift to a critical focus on time, the problem of distinct physical locations does not go away. Sarah Sharma notes that attempts to resist the fast pace of social time often take the form, strangely enough, of spatial strategies. A Slow Food practitioner might go on a pilgrimage to a special restaurant, a farm, or a culinary region, while high-speed business travellers seek refuge in the enclosed space of airport sleeping pods. "Slowness," Sharma writes, "appears to be about getting away, maintaining *distance* from the temporal and the complex multiplicity of time."[10] Arguing that these kinds of "spatial solutions" actually avoid addressing the complex inequities associated with cultural temporalities, she reaches the surprising conclusion that "the cultural turn to slowness is a depoliticization of time."[11]

We may find it useful here to draw a distinction between, on the one hand, slowness as an *escape* from cultural time

(the tactic of spatial distance that Sharma critiques) and, on the other hand, slowness as a form of *engagement* with cultural time. This latter sense of slowness as engagement seems necessary in order to recognize the genuine political efforts involved in, for instance, calls for guaranteed parental leave or for a four-day or three-day work week. Of course, the distinction between engagement and escape is often murky, which is one of the reasons the Slow Movement sparks such passionate debates. In any case, Sharma's critique of slowness applies most usefully to slowness as escape, and indeed the initiative in the Go RVing ad to escape fast culture does regretfully miss an opportunity to engage with the politics of fast culture in favour of firing up the combustion engine to briefly abscond from them.

Given the ways in which "spatial solutions" can serve to depoliticize time, it is especially significant that the spatial solution in the Go RVing ad involves a physical passage into nature, or at least into a somewhat manicured campsite that passes for wilderness. When nature is seen as the spatial home of a pristine, essential slowness, nature's time becomes vacated of its complexities. The ad does not wish to recognize that the natural environment involves fast and urgent temporalities, from sudden storms and fleeing animals to our own encroaching hunger; the attempt to depoliticize nature's time in fact strategically filters and manipulates it. Just as importantly, this kind of representation denies the temporal politics of the links between the environment and human activity. After all, the problems of social acceleration in modern culture play a major role in disrupting the very stability of ecosystems that is so fetishized here. The gas-guzzling RV and the hot dogs, which the family

has acquired through their accelerated, multitasking cultural labours, allow them to make the passage into the campsite, but these items are also emblems of climate change, fossil fuel extraction, and industrial meat production. While the family may appear to leave the suburbs behind, the petroleum-driven world is already waiting for them when they arrive in the forest.

The easy, elegant passage into natural time also hides other forms of cultural messiness that are tangled up in the act of camping. Rather than challenging the fact that camping is typically a "white" activity that requires a certain level of affluence, the ad specifically pitches itself to a white middle-class audience, leaving many other viewers both materially and representationally excluded from the peaceful beauty of nature's time. Even the core values of social acceleration remain stubbornly present in the ad given that the compulsion to organize a camping trip adds yet another item to the family's to-do list, and that this task can then be made more efficient and fast-paced thanks to the fact that "camping" in an RV is much quicker and easier than camping with a canoe and a tent. This is not to mention the improbable vanishing of the family's frantic tensions when they enter the RV. As my dad points out, "The happy scene does not show the RV at a gas station, the family stuck inside in the rain, the driver trying to park in an unknown city, or kids fighting in their seats." The notion of an easy transition between two different temporal worlds, fast culture and slow nature, closes down any conversation about temporal nuance, about the intertwined existence of cultural and ecological temporalities, and about the power and responsibility that are tied to different forms of time.

This analysis sounds pretty negative. And yet, somehow, it is difficult to watch the ad without breaking into a smile. Despite all the problems, there remains a compelling sense in which the advertisement reflects an experience of joy. It asks viewers to delight in the relief from the relentless pressures of the acceleration society. It gives us permission to sigh, to relax, to ignore the demands of scheduling, even for a moment. As a result, it holds out the alluring promise of enabling viewers to step back from the obsessions of everyday time discipline and to re-evaluate the ways in which slowness and ecological awareness might disrupt the problematic assumptions of speed and apparent productivity. There *are* ways in which slower, more thoughtful forms of action already exist within the lives of citizens of late modernity, and this ad might just spark a desire to build on these actions. In a somewhat paradoxical sense, then, even while the ad's problematic representational strategies primarily foster a vision of slowness as escape, the ad also teases us with the possibility of slowness as engagement.

There is value in this sense of delight, in the ability to see social acceleration through a lens of irony, even if the mild countercultural initiative of the ad remains compromised at a deeper level through its unwillingness to account for its contradictions. The ad succumbs to the all-too-common scenario identified by the film scholar Mario Trono, in which the "positive environmental themes" in movies such as *Avatar* conflict with the larger contexts of their production.[12] While the insights that could be gained through a thoughtful re-evaluation of social acceleration and ecological awareness are significant, the ad somewhat inevitably

sacrifices these insights to the needs of selling the idea of consumer spending on campgrounds and RVs.

In identifying the possibilities and limitations of one particular form of representation such as an advertisement, the larger goal should be to develop and put into widespread practice the broader skills of critical temporal literacy. If we can identify the ways in which different representations of time are productive in their reframing of cultural assumptions, the ways in which they are limited and inadequate, or the ways in which they erase forms of time that have important implications for social power and sustainability, then we will be better prepared to read time critically in its systemic operations, and we will also have better insight into the ways in which problematic assumptions about time have infiltrated our own minds.

THE FROZEN ARCHIVE

Closely related to the idea that nature is slow is the sense that the natural world is a remnant of the past, that to enter the wilderness is to travel back in time. Margaret Atwood's short story "True Trash," which follows a group of waitresses working at a summer camp in rural Ontario in the 1950s, is one of many stories that recognize this conceptual divide between the urban world that moves progressively forward into the future and the world of the bush, in which the progression of time is always belated. The radios at the camp cannot pick up any signals, and the records in the recreation hall are "out of date," so the girls sing pop songs to themselves as they wash the dishes.[13] Their singing remains troubled, though, by the realization that the songs they know are no longer the current hits: "'Wake up, little

Susie,' trills Sandy. The Everly Brothers are popular this summer; or they were, on the mainland, when they left."[14] By leaving the city and travelling into the wilderness, the girls have been isolated from progressive time and can no longer participate in the "present" of the larger social world. The observation is an old one in Canadian writing. In a story describing the isolation of an officer of the North-West Mounted Police and his family who are stationed at a remote northern post in the nineteenth century, Pauline Johnson writes that "in those days no railways, no telegraph lines, stretched their pulsing fingers into the Klondyke. One mail went in, one mail came out, each year—that was all."[15] The progress of civilization goes about its business far out of sight, its daily advancements reduced to an always-outdated annual briefing.

Elizabeth Hay's novel *Late Nights on Air* also recognizes this conceptual orientation, using the image of ice as both a key element of the setting and a metaphor for the imperceptibly slow changes in the landscape. Harry, Gwen, Eleanor, and Ralph, who work at a Yellowknife radio station, travel into the Arctic wilderness on a six-week expedition. They have already experienced the thaws of spring in Yellowknife, but as they move into the still-frozen landscape, their voyage is figured as a journey into the past: "They were heading backwards, they realized, into a much later spring of lingering ice."[16] As they move deeper into the icy wilderness, the flow of time regresses further into the deep past. Hay writes,

> On the Barrens something happened to their sense of time. They were living every second of bad weather in a land that was barely out of the

> ice age, a place no different from how it had been a hundred years or a thousand years ago. They were seeing what Hornby and Samuel Hearne had seen, what aboriginal hunters had seen when they hunted here, far back. And so seconds ticked forwards and years swept backwards, and they got used to thinking of time passing in tiny increments and huge leaps.[17]

The disconcerting movement into the past, afforded by the physical journey into the icy wilderness, confounds and reverses their usual experience of progressive time.

Similarly, Thomas Wharton's novel *Icefields* spends many pages lingering over the immense glaciers whose agonizingly slow motion causes ancient ice to flow downward until it reaches the terminus, the place where the temperature passes the melting point and where artifacts from previous eras, even the preserved bodies of doomed explorers, reappear in the thaw. Edward Byrne, who has been exploring the icefield for the Royal Geographical Society, writes, "*The layers of ice deep within the field may be hundreds of years old, formed from snow that fell here before the discovery of America, before the birth of Shakespeare, before the industrial revolution.*"[18] Having narrowly survived a fall into an icy crevasse himself, Byrne patiently waits twenty-five years until the ice that had encased him completes its journey to the terminus, a distance that he can cover on foot "in about seven minutes."[19] When he finds an orchid growing curiously out of place, Byrne scrapes away the grit and ice until he uncovers the remains of the botanical specimen box he had dropped during his fall a quarter-century in the past.[20]

Ice serves as the ideal symbol for the vision of nature as historical repository, and the nuanced representations of ice in Hay's and Wharton's writing spark a sense of awareness, developing a productive vision of nature's archive. Like a museum, ice constitutes a vast storage chamber from which it selectively uncovers and displays fragments of the past. In this way, nature as frozen history invites a sense of longing for an expanded consciousness, for new knowledge about the source of things. It lets us participate in an imagined cultural origin story, a story that can reveal us, in every impressive and disturbing detail, to ourselves. When the snows around Yellowknife melt in the springtime in *Late Nights on Air*, "all the garbage, so thinly but effectively disguised, had resurfaced, soft and soggy and in unbelievable amounts. It was the time of year when winter secrets got revealed."[21] In *Icefields*, this experience emphasizes nature's independence from humanity. As Pamela Banting intriguingly points out, Wharton's narrative is one in which the glacier itself, that slow-motion archive, "is the dominant character and prime mover of events."[22]

However, figuring the wilderness as a physical manifestation of the past can have other consequences too. Like a museum, or indeed like an archaeological site or the lost city of Pompeii, the vision of nature as frozen archive creates a sense not only of connection but also of separation. Visible only behind glass, as it were, the scraps and fragments of the past may spark a sense of recognition, yet they are easily left behind. An intrepid journey into the wilderness, after all, assumes a return home later on. Depending on how it is perceived and embodied within narrative, the temporality of the wilderness from which these fragments emerge can be

at once politicized and depoliticized, a site of startling recognition as well as passive observation. Even the thoughtful vision of ice in *Late Nights on Air* is troubled by the notion that the vaguely identified "aboriginal hunters," who had "hunted here, far back," belong only to an ancient past from which they cannot engage with the modern world.

Less nuanced visions of nature, then, may perceive only an inert realm beyond the pale of temporal relevancy. This perspective feeds a sense of detachment through which the barrenness of nature becomes the curious object of the present gaze, or remains ignored altogether. If nature does not participate in progressive human time, the outright dismissal of nature's time becomes all the more tempting. In the scene where the girls at summer camp have been isolated from the progressive cultural time of pop radio, nature's time risks being erased; it is figured, for them, only as the absence of time.

Tied up in each of these encounters is the problem, typically associated with anthropology, of what Johannes Fabian calls the "denial of coevalness," a distancing strategy in which a dominant group represents another group as existing in a past era out of which the dominant group has long since progressed.[23] The denial of coevalness is a tactic through which colonizers establish their own superiority over the "primitive" people they seek to displace. In the context of relations with the natural world, the denial of coevalness is at work whenever a trip into the wilderness is imagined as a voyage into the past, thus denying the reality of an ecosphere whose ongoing present existence is intimately tied to the unfolding events of contemporary human societies.

PLANET EARTH, UNRESOLVED

From discussions of the past, I want to switch now to visions of the future in the form of science fiction and speculative fiction. Like representations of the past, imaginative portrayals of the times ahead can also vacillate, in illuminating ways, between the desire to engage with the politics of the many temporalities of nature, and the desire to erase nature's time. A comparison of three speculative novels—Robert J. Sawyer's *Flashforward*, Emily St. John Mandel's *Station Eleven*, and Waubgeshig Rice's *Moon of the Crusted Snow*—provides a nuanced perspective on these concerns, ultimately suggesting, first, that late modern culture exhibits a deep temptation to sacrifice any sense of ecological time on the altar of human technological dominance and, second, that giving in to this temptation is empirically miscalculated, profoundly dangerous, and very difficult (but not impossible) to escape.[24]

Flashforward, a science fiction novel published in 1999, largely reflects the dismissal of natural time, positing that the very existence of time is tied specifically to human consciousness, a troubling perspective that is especially consequential given the narrative's interest in the fundamental physical laws of the universe. The protagonist, Lloyd Simcoe, is a Canadian particle physicist who runs an experiment at the Large Hadron Collider (LHC) at CERN in an attempt to prove the existence of the Higgs boson, the famed fundamental subatomic particle that is said to give the property of mass to other particles. *Flashforward* was published long before the actual LHC was operational, but it is set in 2009, around the time that Higgs boson experiments were anticipated to take place. (This prediction turned out to be quite

accurate, as data from the real LHC confirmed the existence of the Higgs boson in 2012.[25]) In the novel, however, the experiment does not go as planned. When Lloyd's team powers up the LHC and switches on the particle accelerator, every person on earth loses consciousness for more than two minutes and sees a vision of themselves twenty-one years in the future; or, more accurately, their consciousness is actually transported into their future selves.

Much of the narrative serves as a thought experiment about how the Flashforward event should be interpreted, both on the level of the physical nature of time and on the level of human reactions to conflicting evidence about the existence of free will. At first, the Flashforward event appears to have revealed the "true" future, suggesting that free will must not exist because the future has already been determined. Later on, some people set out to disprove the envisioned future by, for instance, growing a beard when their future self was clean-shaven, or, in some cases, committing suicide when their future self was alive. The completion of these acts implies the existence not only of free will but also of many different universes, each with its own timeline. Then again, the characters observe, if infinite timelines already exist to account for all possible events, then free will may in some sense be meaningless.

As the characters discuss the implications of these astonishing developments, and as Lloyd's team takes steps to try to create a second Flashforward event, their conversations become increasingly preoccupied with the central role of human consciousness. When Lloyd wonders whether animals might attack humans who have blacked out during the next planned Flashforward, his fiancée Michiko says,

"Interesting thought. I guess animals didn't lose consciousness during the Flashforward, did they?" Lloyd considers the question and responds

> We certainly didn't see the ground littered with dead birds that had fallen out of the sky. And, according to the news reports, no one found giraffes that had broken their legs by falling. The phenomenon seemed to be one of consciousness; I read in the *Tribune* that chimpanzees and gorillas who've been questioned by sign language reported some sort of effect—many said they were in different places—but they lacked the vocabulary and the psychological frame of reference to confirm or deny that they'd actually seen their own futures.[26]

This conversation draws a bold distinction between conscious humans and non-conscious animals, suggesting that the minds of nearly all animals are incapable of the advanced forms of perception or cognition necessary for experiencing time in any meaningful sense.

While Lloyd's comment above restricts the sophisticated perception of time to a very exclusive club of humans and perhaps other great apes, the marginalization of the nonhuman world becomes even more pronounced in a subsequent conversation. Michiko begins to wonder why the LHC experiment not only created the Flashforward but also failed to produce any Higgs boson particles. Lloyd is stuck for an answer to this question, but Michiko arrives at a solution. The bosons were not produced, she explains, because

> there was no one to observe them. For almost three whole minutes there wasn't a single conscious mind on Earth—no one, anywhere, to actually observe the creation of the Higgs boson. Not only that, there was no one available to observe *anything.* That's why all the videotapes seem to be blank. They *look* blank—like they've got nothing but electronic snow on them. But suppose that's not snow—suppose instead that the cameras accurately recorded what they saw: an unresolved world. The whole enchilada, the entire planet Earth, unresolved. Without qualified observers—with *everyone's* consciousness elsewhere—there was no way to resolve the quantum mechanics of what was going on. . . . Without any conscious beings anywhere, reality breaks down.[27]

These comments, and the larger world that *Flashforward* imagines, deduce that the very existence of time, and indeed of reality, depends on human intelligence. Other species have no place, no time, and no future without humans to perceive and imagine the narrative of events.

In the final stages of the novel, Lloyd becomes one of very few people to successfully experience a subsequent Flashforward. In this more complex series of visions, Lloyd witnesses the entire future trajectory of the universe, and he realizes that his future human consciousness has been installed into an immortal android body, "a new body, all silver and gold, smooth and shiny."[28] While humanity had previously represented the solitary seat of consciousness, the lone perceiver of legitimate temporal experience to the

exclusion of the rest of the ecosphere, this new vision reveals a world in which humanity has chosen to dispense entirely with its own biological existence. If biology is what tethers human beings to the unworthy natural world, then Lloyd's android body is the logical conclusion of the dismissal of nature for experiencing or contemplating time.

This vision is the ultimate confirmation of a fear expressed by the environmental philosopher Neil Evernden. In his lament about a form of humanity that sees itself as the final measure of all things, he asserts that "once meaning is confiscated by a single source, the world is devalued, transformed into an empty vessel containing materials for human use."[29] Evernden, of course, is not thinking of a scenario from science fiction; he is describing our own world of petroleum extraction, mining, and deforestation, all of which he sees as predicated on the denial of meaning, consciousness, and unmeasurable value in the nonhuman. Ironically, the final deep future scenes of *Flashforward* almost seem to draw inspiration from Evernden's fears about the world as a store of materials for human use, as we see that the planet earth has been dismantled in order to construct a glorious metal semisphere around the sun, "capturing every photon of energy that fell upon it."[30] Then again, the notion of "human use" is no longer accurate, it too having been discarded during Lloyd's transformation into his post-human form.

All of this is not to say that there is something wrong with stories that explore the limits of consciousness and human identity through spectacular future events such as the intentional destruction of the planet. So much depends on the tone of a narrative and the extent to which it fully

envisions its world. *Flashforward* is in many ways a thoughtful, imaginative, and playful novel that enables us to speculate on a deeply intriguing scenario. Worryingly, though, the dismissal of the natural world as incapable of undergoing temporality outside the gaze of humanity is presented here quite earnestly, without a sense of irony or critique, through dialogue that is constructed essentially to frame the terms of the book's thought experiment.

It might be tempting to say the difficulty with *Flashforward* is that it simply misunderstands reality by neglecting the independent existence of the nonhuman world, yet its philosophical orientation actually borrows from certain theories of reality proposed within the sciences. Paul Davies, a theoretical physicist and well-known popular writer on scientific discoveries, argues that the flow of time is inherently subjective and that "nothing other than a conscious observer registers the flow of time."[31] If this is the case, then *Flashforward* perhaps imagines the reality of the world more clearly than most narratives. Then again, many scholars in various disciplines, as well as practitioners of other traditions of thought, have attributed consciousness and agency much more widely to animals, the ecosphere, and even trees.[32] Environmental philosopher David Abram, for instance, presents a detailed study of the forms of perception, subjectivity, and temporality in the natural world.[33] What is largely at stake in these debates is the problem of defining consciousness, or even the notion of "being," a problem that is hazy, messy, and of fundamental importance for assessing the relationship between humanity and nature. As Michelle Bastian has observed, the tendency to

see nature as timeless is closely linked to the belief that nature lacks any sense of agency.[34]

At the very least, the restriction of consciousness and temporal perception to human beings is suspect. Ironically, the very existence of the Higgs boson particle lends some scientific legitimacy to the ostensibly dubious notion of the kinship of all things, the very notion that is so easily dismissed in *Flashforward*. Science reporters Kate Lunau and Katie Engelhart explain that the Higgs boson particle and its associated field encompasses every structure in the universe, "giving mass to elementary particles within it: the stuff that makes up stars, planets, trees, buildings, animals and all of us. Without mass, electrons, protons and neutrons wouldn't stick together to make atoms; atoms wouldn't make molecules; none of us would exist."[35] In this context, as in the ecological context, the act of drawing a clear dividing line between human beings and the rest of the ecosphere is a strange and radical one.

As readers of science fiction tend to understand, stories that speculate about fantastic future scenarios can be among the most deeply invested in debates about reality and the place of human beings within the larger world. The perspectives on time that shape narratives such as *Flashforward* occur within the larger framework of the primacy and specialness of human consciousness, leaving other elements of the ecosphere firmly outside of the temporal, and the experience of reading such a story can compel us to consider the troubling implications of more mundane narratives as well. A story about time travel and android bodies can shed light on the everyday visions in which natural time is not even worthy of depoliticization but is erased altogether.

DORMANT ON THE RUNWAY

If *Flashforward* muses on the technology-driven future of temporality in a way that marginalizes nature, Emily St. John Mandel's speculative novel *Station Eleven* (2014) reveals the intricate web of entanglements between human, technological, and natural temporalities. By taking these entanglements seriously—by representing elements of nature, for instance, as complex agents that can act through human culture—*Station Eleven* becomes an argument against the erasure of nature's time and against the simplistic vision of slow nature and fast culture. By imagining the collapse of a society that has collectively failed to appreciate that the temporalities of nature and culture are always diverse and intertwined, the novel suggests that the modern acceleration society is fundamentally unstable and perhaps inevitably apocalyptic.

The novel opens in present-day Toronto, where one of the protagonists, Jeevan Chaudhary, is attending a stage production of *King Lear*. Soon we start to see reports of an alarming new strain of flu that seems to have originated in the Republic of Georgia and is quickly spreading through Toronto. After leaving the theatre, Jeevan receives a phone call from his friend Hua, a doctor at Toronto General Hospital, who sounds frightened and exhausted. The first flu patient had arrived at the hospital the previous night after a flight from Moscow and was quickly followed by over two hundred more cases.[36] "I don't know what's going on," says Hua. "It's a flu, that much is obvious, but I've never seen anything like it. It is so fast. It just seems to spread so quickly . . . It's the fastest incubation period I've ever seen."[37] Hua soon reveals that every patient from the Moscow flight

has died.[38] While frantically loading stockpiles of groceries into shopping carts, Jeevan calls his girlfriend, Laura, and tells her to leave the city:

> "There's a flu epidemic, Laura. . . .
> This flu's serious, and it's fast."
> "What's fast?"
> "This flu, Laura. It's really fast."[39]

These early pages of the novel present a virus that is notable primarily for the speed at which it kills, but the idea of a fast flu confuses the characters; Laura's momentary inability to understand the flu virus as a form of fast agency speaks to the larger cultural sense of complacency or denial of the ways in which supposedly slow nature can rapidly transform the global order. The gradual realization that the flu is fast challenges the idea that modern society is the primary driver of speed. On the levels of both public health measures and individual reactions, the human response to the unfolding crisis is haphazard and ineffectual, and it cannot possibly match the speed of the outbreak—the virus goes on to kill nearly all people on earth within a few days. As Clark, one of the survivors, later observes, "not only had the Georgia Flu arrived, but it was already everywhere."[40] In these scenes it is humanity, not nature, that is hopelessly slow.

In his study of social acceleration, Hartmut Rosa argues that modernity is defined by a "self-reinforcing" cycle of acceleration tied to rapid changes in technology, social change, and the pace of life,[41] but where Rosa sees an internally driven human society of speed, *Station Eleven* sees the virus as a key participant and, in a twisted sense, both the

victor and the annihilator of social acceleration. Of course, the speed of the virus is partly enabled by fast culture in the first place, particularly by jetliner air travel, which makes the acceleration society a conspirator in its own destruction. The virus transmits an ironic perspective on fast culture just as much as it transmits disease.

Some of the most powerful symbolism in *Station Eleven* comes about through recurring images of transport technologies that now sit motionless, a motif that also casts a heavily ironic eye on social acceleration. Many of the characters trudge through expressways—iconic images of the modern infrastructure of speed—that have been permanently gridlocked by abandoned cars. The pace of the expressway becomes the pace of long, slow walking. After the collapse, massive jetliners sit motionless for twenty years: "They stood dormant on runways and in hangars. They collected snow on their wings. In the cold months, they were ideal for food storage. In summer the ones near orchards were filled with trays of fruit that dehydrated in the heat."[42] The stationary airplanes are hulking metaphors for the termination of the acceleration society, an irony heightened by the fact that the planes had enabled the rapid global spread of the virus. The image of immobilized, and immobilizing, transportation technologies is visible in Jeevan's exhausting efforts, over the course of an hour, to force seven fully loaded shopping carts through the snow toward his brother's high-rise apartment,[43] in the pickup trucks that have been gutted and converted into horse-drawn caravans in the post–fossil-fuel society,[44] and in the wheelchair that confines Jeevan's brother Frank to his high-rise for weeks after the collapse, while the elevators, too, sit motionless without electricity.

Accompanying all these images is the apparatus of instant global communication—the cell phones, laptops, and televisions—that now sits dead, useless, and abandoned. Through these images, the narrative defamiliarizes our existing world of airplanes and phones by emphasizing both the wonder and the fragility of the networks of fast travel and fast communication. As the technological infrastructure of speed is instantly disabled by a fast virus, and then very slowly rusted and consumed by rain, wind, and moss, the narrative not only recognizes the force and multiplicity of the temporalities of nature but also casts natural time as an initiative toward irony, as a collection of agencies that make the human world of globalized speed appear suddenly very small and temporary, and as radically intertwined with, not separate from, ecology.[45]

The post-apocalyptic sections of the narrative follow Kirsten and other members of a travelling theatre company and symphony as they wind their way from town to town in their caravans, performing music and Shakespeare. "Twenty years after the end of air travel," we are told, "the caravans of the Travelling Symphony moved slowly under a white-hot sky."[46] Even as the story forces the reader to view modern culture from an unfamiliar perspective, it resocializes us into a world where travel and communication operate at the speed of walking, where each town or settlement is its own form of space station adrift in the universe, a parallel to the *Dr. Eleven* comic books that tell the story of the damaged, isolated Station Eleven space station "hiding in the uncharted reaches of deep space."[47] In the new world, life is usually slow-paced. People grow crops, find water, and talk, as time becomes both more intimate

and more expansive. Characters reminisce with disbelief at the idea that they used to write "THX" in emails because it would take too much time to write "thanks."[48] A large group of survivors stranded at the Severn City Airport diligently count the days after the collapse while they wait for the National Guard that never arrives, until eventually they change their calendar system, calling the years Year One, Year Two, Year Three. Mandel writes, "Time had been reset by catastrophe."[49] The process of resocializing themselves into a world that operates at walking speed is inevitably a gradual, often painful, experience of shifting temporal reorientation that simply cannot be avoided.

Clark, one of the survivors living in the Severn City Airport for twenty years, has created what he calls the Museum of Civilization, an array of ordinary pre-collapse items displayed in an area "which had formerly been the Skymiles Lounge."[50] His relics include "the laptops, the iPhones, the radio from an administrative desk," and other items whose functions he has to explain to those born after the pandemic.[51] The name of the room—the Skymiles Lounge—reflects the contradictory impulse of the narrative, in that it juxtaposes, in "Skymiles," the fantastic speed of modern technologies of flight, with "lounge," the stationary practice of waiting. The novel itself, and the experiences of its characters, describe the jarring transition of temporalities embodied by the Skymiles Lounge.

The form of the narrative, too, involves many transitions back and forth between the old world and the new world, so that we reflect on and, in a sense, experience the juxtaposition of these worlds in the same way the characters do: at first through the assumption that the world of

cell phones and airplanes will exist forever, then through the sudden and incredible collapse, and finally through the gradual acceptance and construction of a new world characterized not only by new forms of temporal experience but also by endless flashbacks—the "barely submerged" memories of fast modern culture—that continue to shape the survivors' identities even twenty years later.[52] Understanding the collapse at a human level requires a narrative that addresses the instantaneous unfolding of the outbreak on social media and also addresses an evening spent baking bread two decades later—a moment that is in Jeevan's "present" but also encompasses all that has happened over a period of many years.

I have previously suggested that a narrative that indoctrinates people into shared forms of social time can be understood as a time socialization story. The elements of *Station Eleven* discussed above indicate that this novel, like various other thoughtful works, operates as a time *re*socialization story. The novel defamiliarizes our common understandings of the speed of modern travel and communications, disrupts complacent assumptions about the slowness or temporal irrelevance of nature, and socializes readers into a slower post-collapse temporality in which human–ecological relations have been radically shifted. After finishing the book, readers may find themselves looking at their own everyday world, with its fast technologies and its disinclination to engage seriously with the temporal expressions of nature, as a living Museum of Civilization.

In their study of the infamous outbreak of severe acute respiratory syndrome (SARS) in 2003, Yanqiu Rachel Zhou and William D. Coleman examine the problems of time

and speed that were central to the rapid global spread of the disease. Advances in transportation networks over the past few decades, they explain, "have accelerated contemporary globalizing processes which, in turn, have changed the speed of the circulation of pathogens. In response, actors at all levels of global public health are pressed to speed up their responses."[53] Fast travel technologies enabled the fast spread of the disease, which then required fast action from health agencies. SARS was eventually contained, but the all-too-possible scenario in *Station Eleven* is one in which this cycle of acceleration finally crashes apart, largely because of the addition of one more factor of acceleration, the fast action of the virus in killing its human hosts—a factor that is unexpected because it is "natural," not technological.

At the end of his study of social acceleration, Rosa asserts that the self-reinforcing cycles of acceleration tied to modernity represent an "unbridled onward rush into an abyss" of unfathomable repercussions, which "will be embodied in either the collapse of the ecosystem or in the ultimate breakdown of the modern social order."[54] Like Rosa, *Station Eleven* imagines a final destabilization of the modern cycle of acceleration. However, while Rosa assigns the ecosystem a relatively passive status as a backdrop awaiting its own destruction, *Station Eleven* more fully imagines the ecosystem, in the form of evolving viral nucleotides conspiring with jet travel, as the actual agent of the breakdown of the social order. Ironically, the ecosystem in *Station Eleven* does not collapse, as we so often fear it will. Instead, it speeds up until the sickness becomes so fast that mere humans cannot keep pace with it.

MOMENTARY CHAOS: AN INDIGENOUS APOCALYPSE

Conspicuously absent from many apocalypse stories is a focus on the experiences of Indigenous Peoples, but Indigenous perspectives can cast a radically different light on the notion of civilizational collapse and its ecological contexts. *Moon of the Crusted Snow*, a 2018 novel by Waubgeshig Rice, who comes from the Wasauksing First Nation, is an apocalypse story that grants imaginative access to a key insight: for a First Nation that has endured colonization, the apocalyptic collapse of the infrastructure of modernity is merely one event, a "momentary chaos," in a much longer chain of events that have necessitated deep skills of social independence and survival. For the characters in the novel, this orientation is expressed in temporal terms through close attention to the rhythms of ecological time and through a sense that their Indigenous nation had always been somewhat removed from the temporalities of modernity. The collapse of modern time is not a singular catastrophe but a disruption that gives rise to a calculated, renewed attention to ecological temporalities that have never been emptied or depoliticized but have always been closely observed.

The story focuses on the character of Evan Whitesky, a member of the fictional Gaawaandagkoong First Nation, a remote community several hundred kilometres north of Toronto. The opening scene finds Evan hunting a moose in the bush near the reserve in order to stockpile food to feed his young family during the approaching winter. In *Station Eleven*, a scene along these lines would take place in the post-apocalyptic world, but in *Moon of the Crusted Snow* this scene establishes the context of Evan's everyday life. After butchering the moose at the site of his kill, Evan

ties the carcass onto a trailer behind his all-terrain vehicle and tows it home, where he comments to his wife Nicole that he wasn't able to update her on his hunting progress because his cell phone battery had died. The temporality of Evan's daily life is thus a blend of ecological time—the fall hunt, the coming winter, the need to return home before dark—and the temporality of late modernity with its instant communication networks. The dead cell phone battery foreshadows the coming total collapse of the communications infrastructure, but in this early incident the dead battery implies that the technological world of the settler society is simply not reliable and that Evan quite easily accepts this limitation. The failure of the phone is a disruption, but it does not fundamentally change his activity of the day. This sense of disruption and resilience can be said to be encapsulated in the first sentence of the novel: "A crack echoed through the boreal landscape, a momentary chaos in the still afternoon air."[55] The gunshot, suggestively described here as a breakage of the setting of Evan's life, does not represent a total collapse. Like the apocalypse to follow, it is merely a "momentary chaos."

If Evan's hunt in the opening scene establishes the sense that his life is somewhat separated from the larger urban settler culture, many of the other early scenes expand this notion, indicating that the Gaawaandagkoong First Nation has always been partially removed—physically, electronically, and conceptually—from the world that they refer to as "the South." Food is routinely trucked in from the South, but Evan "felt detached from that food. He'd learned to hunt when he was a boy out of tradition, but also necessity."[56] Cell phone network outages are common on the reserve,

but because the network and the hydro grid connection had been established only a few years earlier, "many of them hadn't yet developed any sort of serious dependence on the service. An outage didn't evoke any real sense of frustration or panic."[57] Ultimately, the community is both connected to, and distant from, the cultural centre emblematized by packaged food and electronic signals. The extent to which they are connected to these things is the extent to which the collapse of the infrastructure will be devastating, and the extent to which they are distant is the extent to which the collapse will be felt as a mere disruption seen from afar.

When the collapse actually occurs, Evan and his neighbours come to the realization only gradually. First the satellite TV signal goes down, then the cell network and the larger Internet connection, followed by the electricity from the hydro station. Shipments of food and diesel do not arrive, and even the shortwave radio goes silent. These gradual scenes are far removed from the usual staples of apocalyptic fiction where panicked citizens run through the streets as the news networks recount the catastrophe live on air. Indeed, one of the most striking features of *Moon of the Crusted Snow* is that we never learn the cause of the collapse. A nuclear bomb? A solar flare? A zombie outbreak? None of the usual scenarios seems to fit the available evidence, and the disaster in the South remains hidden from view. Whatever has happened must have taken place incredibly quickly since there were no news reports about it. On the reserve, though, the disaster is slower, more drawn out, and it is something that has happened primarily to other people far away. Speculating about the state of Toronto, where her nephew Will has been living, Nicole "pictured her young

nephew frightened as hungry mobs rolled through the bigger city streets where he lived."[58] The presumed chaos in the cities is experienced not in its horrific immediacy but as an exercise of the imagination, and the gradually unfolding temporality of these visions reflects the reserve's location on the margins.

The sense of distance from the centre of modernity is tied up with the history of the Gaawaandagkoong First Nation as a society that has already survived catastrophes in the past, and this longer history of tragedy helps to develop a significant theme in the novel. A number of scholars have shown that for Indigenous societies living within a history of colonization, the apocalypse, in a very real sense, has already happened. In his study of the relationship between disease and colonization, James Daschuk notes that "the importance of introduced infectious disease cannot be overstated in the history of indigenous America."[59] He points to the fact that "mortality from initial infections of smallpox has been estimated to be as high as 70 percent or more."[60] The philosopher Kyle Powys Whyte, who is a member of the Citizen Potawatomi Nation, identifies additional catastrophic events, noting that

> Anishinaabek already inhabit what our ancestors would have understood as a dystopian future. Indeed, settler colonial campaigns in the Great Lakes region have already depleted, degraded, or irreversibly damaged the ecosystems, plants, and animals that our ancestors had local living relationships with for hundreds of years and that are

> the material anchors of our contemporary customs, stories, and ceremonies.[61]

This is not even to speak of the horrifying legacy of the Canadian system of residential schools, widely considered a form of cultural genocide. The present moment, for Indigenous societies, is in some ways a post-apocalyptic world where the recovery of cultural structures is a slow, difficult process.

In *Moon of the Crusted Snow*, Aileen Jones is the central elder of the Gaawaandagkoong, and as she speaks about the history of the community she comes to embody both the traditional way of life and a sense of hard-won experience in the skills of survival. After telling Evan that there is no Ojibwe equivalent to the "silly word" of "apocalypse,"[62] Aileen explains,

> Our world isn't ending. It already ended. It ended when the Zhaagnaash came into our original home down south on that bay and took it from us. That was our world. When the Zhaagnaash cut down all the trees and fished all the fish and forced us out of there, that's when our world ended. They made us come all the way up here. This is not our homeland! But we had to adapt and luckily we already knew how to hunt and live on the land. We learned to live here. . . .
>
> But then they followed us up here and started taking our children away from us! That's when our world ended again. And that wasn't the last time. . . .

> Yes, apocalypse. We've had that over and over. But we always survived. We're still here. And we'll still be here, even if the power and the radios don't come back on and we never see any white people ever again.[63]

The efforts of the community to retain their traditional knowledge are closely linked to the necessity of surviving on the margins. The constant that always remains with them through the repeated acts of destruction is the ability "to hunt and live on the land," the same form of knowledge that Evan demonstrates in the opening scene and which requires self-conscious allegiance to natural time.

The middle stages of the narrative are characterized by a tension between the persistence of survival skills and the fact that many people in the community are much more vulnerable than Evan. His brother Cam, for instance, represents the dangers of becoming lost within the settler society's obsession with its own constructed world: "When Evan had been out on the land learning real survival skills with his father and uncles as a teenager, Cam had chosen to stay behind, learning simulated ones in video games."[64] Deaths by freezing, sickness, violence, and suicide occur throughout the reserve as the months drag on. The menace of the colonial society is symbolized most obviously by Justin Scott, an ominous, powerful stranger who arrives on a snowmobile and proceeds to ingratiate and bully his way into the community. He eventually becomes the *windigo*, a cannibal monster whose secret food supply is the bodies of the people who have died. Scott's mocking pronouncement, "White man always saves the day!,"[65] ironizes the settler society's

twisted influence and represents the abyss from which the community must escape.

The escape itself, the resilience through which the community lives on, takes the symbolic form of the traditional language, known alternately as Ojibwe or Anishinaabemowin. Specifically, Evan achieves the most optimistic form of resilience when he stops "counting the days and weeks"[66] and instead shifts to the Anishinaabe system of time reckoning, a shift that is tied to the novel's titular interest in the "moon of the crusted snow." Nicole and Evan both suffer from nightmares about sinking helplessly into deep powdered snow covered in an icy crust that is too thin to support their weight. In a key passage, Evan struggles to remember the Anishinaabemowin word for the "specific time of year" when such a crust tends to form, and eventually the name comes to him: "'Onaabenii Giizis,' he proudly proclaimed out loud. 'The moon of the crusted snow.'"[67] Soon afterward, as the winter draws to a close, the actual crusted snow on the reserve becomes compacted and is easier to walk on, so that "they sank less each day."[68] The Anishinaabe system of naming the months, or moons, coincides with the resilience and survival of the community. Indeed, the structure of the novel echoes the importance of the Anishinaabe system of marking natural time; the book comprises sections named after the seasons, first in Anishinaabemowin and secondarily in English. Part One, for example, is titled "Dagwaagin," with the word *Autumn* printed underneath.

In the climactic scene, where Evan confronts Scott about his cannibalism, Scott shoots and apparently kills Evan, and is in turn killed by another stranger, a white woman who

had recently arrived. The novel closes with an epilogue that takes place nearly two years after the collapse: Nicole leaves the reserve in order to join the remaining community members who have built "their own settlement away from this town,"[69] and is accompanied by her children, who have always symbolized the future of the community and whose Anishinaabemowin given names imply the reclamation of traditional knowledge. While Evan's apparent death could be read as the destruction of the resilience that he embodies, the epilogue emphasizes that the persistence of the community is larger than any one individual. The Gaawaandagkoong can and will survive through future generations.

While the narrative in *Station Eleven* switches powerfully back and forth in time from the pre-collapse world to the post-collapse world, creating an all-defining distinction between the before and the after, the narrative sequence in *Moon of the Crusted Snow* moves gradually through a series of transitions, none of which are absolute. As with the previous apocalyptic events that the community has endured, the current collapse is ultimately just one component of a larger narrative of existence, a working through of disasters that arise from time to time, all of which take place against the long-term background of traditional connections to the land. For the Gaawaandagkoong characters, apocalypse shifts their orientation to the temporalities of nature by degrees. While the daily life of any community, either settler or Indigenous, always embodies a blend of natural and cultural time, the settler world often denies or expresses hostility toward the elements of natural time that remain inevitably important. The Gaawaandagkoong community, by contrast, has maintained a self-conscious attention to

their distinct blend of natural, settler, and Indigenous time. They have never stopped taking ecological time seriously.

Station Eleven and *Moon of the Crusted Snow* emphasize very different perspectives, but in its own way each one illuminates how a thoughtful narrative can enrich our imaginative awareness of the hazards and possibilities of cultural and natural time. They argue that cultural temporalities—diverse and contradictory—are always engaged in negotiations with forms of ecological time, which in turn can be either reassuringly consistent or terrifyingly abrupt. The problematic assumptions we often make about natural time—that nature is slow, that nature is frozen, that natural time is picture-perfect or empty or irrelevant—are failures of the imagination as well as failures of knowledge. Any number of disciplinary approaches can be useful for correcting our failures of knowledge, but good stories can fill in the gaps in our imaginations.

While the RV that opened this chapter is a vehicle that risks carrying us, as all-too-willing passengers, into simplistic visions of escape, we might still try to reclaim the term *recreational vehicle* for other purposes. Such a suggestive phrase need not remain ensnared within the context of suburban car culture and campground getaways. We might say that a good narrative, one that challenges and rethinks cultural and natural time, is itself a form of recreational vehicle. It is an instrument through which we might *re-create*, or once again form, our conceptual orientation toward nature's time.

When we consider such stories alongside the other representations discussed here—the Go RVing ad with its

escape from fast culture into slow nature, the ambivalent vision of nature as a frozen archive, or the erasure of natural time within a worldview that privileges human consciousness—the larger picture that emerges is one that must refuse the simplistic dichotomy between fast and slow and between human time and natural time. A more nuanced perspective must understand nature and culture as internally diverse, shifting, and mutually influential. Once we have taken apart the assumed link between nature and slowness, between culture and speed, only an everyday temporal literacy remains to discern the complex politics of natural and cultural time.

THE ARCTIC ALLIGATOR SWAMP

By now it is clear that our narratives of time are vitally important for shaping our relationships with the natural world; yet, as some of the earlier chapters have also revealed, human beings do not have complete autonomy over these narratives. We live in a world that is not just social and cultural but also ecological, and in many ways the ecosphere is a co-author, as it were, of our stories of time. This notion has unfolded through reflections on king crabs and grolar bears, Higgs bosons and the wobbling of the planet, each of which plays an evolving role in the stories we tell about the time of the world.

This final chapter will zoom out, one last time, to see how far we can push against the frame of our picture of natural time. An imaginative awareness of the Anthropocene and its contexts can confirm the immense stakes

and the vital necessity of examining the everyday practices of narrative. Thinking about the deep past and the deep future can open up a vision of the deep present, so to speak, in which our own time must be understood in relation to untold ages. Within such a context, the notion of resilience becomes especially significant. After all, human beings, ecosystems, climate disruptions, and narratives all exhibit degrees of resilience, and the notion of "bouncing back" and persisting through time is one that we must compete for. As this chapter will show, resilience can thus enable both inspiration and terror. What can grant us more hope, and what can instill more fear, than the idea of something that recovers and recovers again, no matter how much it is disturbed? Much like narratives, the ecological temporalities in which we live are pliable mediums that we can shape to suit our purposes, but they are also forces that extend beyond our control. They shape us as much as we shape them. Seeing ourselves within the deeper context of time and resilience reveals that the earth and the stories we tell about it deserve to be read with both a sense of irony and a sense of respect.

LOOKING FORWARD TO CLIMATE CHANGE: RESILIENCE AS IRONY

A recent palaeobiological study describes an enormous flightless bird that lived 50 million years ago in what is now the northern Canadian territory of Nunavut. At that time the Arctic was "a hot, swampy environment, home to giant turtles, alligators, primates and hippo-like beasts."[1] One of the study's authors, Jaelyn Eberle, somewhat shockingly points out that this information "gives us some idea of what to expect as climate change dramatically alters the

northern landscape."[2] The realization that we are recreating such an ancient and unfamiliar past lends a particular sense of bemusement and horror to Elizabeth Kolbert's observation that because "humans are putting carbon back into the air that has been sequestered for tens—in most cases hundreds—of millions of years . . . we are running geologic history not only in reverse but at warp speed."[3] If you have been watching for the ultimate ironic perspective on the notion of progress, this might be it.

Eberle, of course, is not announcing a literal return of the conditions of the Eocene epoch. Even if the Arctic alligators in some sense reappear, they will not be the same alligators that are visible within the ancient fossil record, and their environment will not be the same as that of the Eocene. In the living world, cyclical time is never entirely cyclical, and the past never really comes back. Nevertheless, the conceptual link between the Arctic of the deep past and the Arctic of the future involves a strange and perhaps uncomfortable form of resilience. What does it mean for the sustainability or resilience of human societies if the alien ecosystems of the prehistoric earth provide a glimpse of what we can *anticipate* as carbon combustion gives way to global heat? Bishnupriya Ghosh notes that the etymology of the word *resilience*—from the Latin for "rebound or recoil"—implies a sense of "physical elasticity," involving "the capacity to return to a prior state after deformation (in physics) or disturbance (in the biosciences)."[4] If ancient human-free ecosystems, or something like them, "bounce back" due to our carbon emissions, there is a sense in which the concept of resilience becomes our enemy. As we wait for the Arctic alligator swamp, so to speak, we may find that the multiple

crises associated with climate change and ecological disruption require us to rethink the links between deep time and everyday time, past and future, progress and regress. Inside the gaping maw of the alligator, that most resilient of creatures, is the sinister challenge that ecological crisis poses to our notions of time and narrative.

The work of literary theorist Paul Ricoeur will prove useful here one last time, in his claim that "time becomes human time to the extent that it is organized after the manner of a narrative."[5] This insight from Ricoeur has been deeply valuable to me. And yet, the comment seems to contain an uneasy assumption that the process through which time takes form works inevitably toward human purposes. When it comes to narrative, this comment implies, humans are the star of the show, and if the essence of narrative is that it structures time, then time seems to be a fundamentally human process. Of course, we might come to Ricoeur's defence by pointing out that our own understanding of things is inevitably human, that "human time" is simply the only form of time that we have access to, the only kind that holds meaning for us. Still, as we have seen, the notion of the ecosystem as a passive backdrop to human affairs is a dangerous one. If the future conditions of climate change may in some sense recreate ancient ecosystems like the Arctic alligator swamp—if humanity has been merely a temporary interruption to the longer-term residency of other creatures—then perhaps the protagonist of the narrative was never human in the first place. Perhaps, to the extent that it is organized after the manner of a longer narrative, time becomes alligator time.

In order to de-socialize ourselves from time, to emphasize the fact that time has never been entirely ours, I therefore propose a new definition of humanity: we are a mechanism for prehistoric ecosystems to resiliently recreate themselves. A strange thought. It feels good to be resilient, but it feels uncomfortable to become the medium for someone else's resilience, to tell a story only to find out that it's not about us. Ecosystems have a way of turning our most earnest narratives into irony.

Irony has often been the hidden double agent within the notion of resilience. As a concept within social theory, resilience takes shape through multiple and sometimes competing forms: one person's resilience might be another person's exploitation.[6] In other cases, an insistence on resilience might paradoxically increase the "commitment to failing courses of action."[7] The case of the Arctic alligator swamp suggests that if resilience is always the resilience *of* someone or something, then the question of who that someone is may unfold in unexpected ways if we consider nonhuman agencies and longer time scales. The alligator swamp can help us to see irony not just as an incidental feature of certain resilient enterprises but as central to resilience itself. The alligator swamp is a story that demands the resilience of the human species even while it narrates the re-emergence of a long-lost world that doesn't include us. It is a narrative of the fulfillment of resilience and the end of resilience. As such, it requires us to see the very notion of resilience through both an earnest and an ironic perspective, as an inevitability and an impossibility. It reveals that resilience has always been something to desire as well as something to fear.

SHAKESPEARE'S GERMS

Christian Bök, an experimental poet, has developed what could be called a desperate measure for overcoming the Arctic alligator swamp. He has taken on the challenge of writing poetry "in the medium of life" and has created a method for extending humanity's presence into the deep future.[8] When he is not teaching creative writing to his own students, he has been using his research funding to teach himself genetics and computer programming and to carry out experiments of his own design within genetics laboratories, all with the goal of inserting a sonnet, called "Orpheus," into the genetic code of a bacterium. This, however, is only the beginning. The sonnet is enciphered in such a way that the bacterium, by converting the inserted DNA sequence into RNA in preparation for the synthesis of a protein, creates a mirrored genetic sequence that comprises another sonnet, one that is pre-arranged by the cipher of Bök's invention. This second sonnet is called "Eurydice."

Bök claims that this experiment, called "The Xenotext," results in a bacterium that both "reads" and "writes" the pre-arranged poetry. What is more, this bacterium—a highly "cultivated" organism, if you will—could potentially continue this literary process for eons to come. Bök explains,

> The cell becomes not only an archive for storing a poem, but also a machine for writing a poem. The gene has, to date, worked properly in *E. coli*, but the intended symbiote is *D. radiodurans* (a germ able to survive, unchanged, in even the deadliest of environments). A poem stored in the genome

> of such a resilient bacterium might outlive every civilization, persisting on the planet until the very last dawn, when our star finally explodes. . . .
>
> All poets pay due homage to the immortality of poetry, but few imagine that we might write poetry capable of outlasting the existence of our species, testifying to our presence on the planet long after every library has burned in the bonfires of perdition.[9]

If Bök's plan succeeds, the Xenotext will become a kind of living Voyager probe, carrying fragments of human meaning into the untold depths of time and space. As Susan Vanderborg puts it, "his transgenic texts' duration, if successful, would far exceed the promised reach of Shakespeare's 'So long as men can breathe, or eyes can see.'"[10]

Alongside his poetic musings on the genetic project, Bök's book *The Xenotext: Book 1* also includes a series of poems contemplating such catastrophes as the asteroid impacts of the Late Heavy Bombardment on the ancient earth and the terrifying twenty-first century phenomenon of colony collapse disorder, which threatens to destroy bee populations and leave countless food crops unpollinated. Despite the darkness of these related materials—or indeed, in response to this darkness—Bök's comments on the Xenotext project take on a decidedly celebratory tone, lauding the potential of his sonnets to transcend the usual tests of time. These sonnets, he claims, will challenge the ultimate limits of deep time. They will survive the catastrophes of eons, outlasting humans, insects, and even the configurations of rock that comprise our familiar planet.

Suffice it to say, many of Bök's comments embrace a profoundly earnest sense of resilience. And, in a sense, this is well deserved. The project is impressive: Bök's sonnets may indeed last for untold ages, surviving the raging floods, the furious fires, the dying crops and oxygen-starved seas, the self-inflicted wounds that threaten to destroy our own civilization. In this sense, the Xenotext performs Bök's intended function, and it perpetually keeps intact a ticking pendulum—read; write; read; write—whose motions describe an endlessly repeating linguistic code. These effectively immortal sonnets may grant, to some vestige of humanity, a resilience far greater than that which our own bodies could ever hope for.

And yet the sense of resilience embodied in the Xenotext also inevitably calls for a perspective shaped by irony. The resilience in question, after all, does not belong to human beings at all, but to the microbial host. As John Charles Ryan explains, "*D. radiodurans* is an extremophilic red spherical bacterium discovered in the 1950s in corned beef that spoiled despite having been irradiated. The bacterium is infamous for its unparalleled resistance to radiation, UV light, desiccation, acidity, and cold. In fact, it can survive up to 1.6 million rad (a unit of absorbed radiation), where 0.1 percent of such radiation is fatal to human life."[11] The bacterium contains many copies of its own genome and, in Bök's words, "with this level of redundancy, the dire seed can repair itself, suturing together fractured sequences of its DNA in less than 24 hours, without mutating or expiring."[12] *D. radiodurans* is a poster child for resilience, and while the Xenotext aims to go along for the ride into the temporal abyss, the project enables human resilience only in the very

limited sense that it identifies a stunningly good medium for the preservation of one fragment of human creativity, arguably a mere curiosity.

Every work of art involves a negotiation between content and form, each of which can be understood as bringing the other into existence. In the case of the Xenotext, the development of the form of the work—a project that has cost "well over $150,000"[13] and has taken years of intensive labour—so overshadows the content that the meaning of the sonnets themselves, "Orpheus" and "Eurydice," seems almost an afterthought. Indeed, the sonnets do not even appear in *The Xenotext: Book 1*, reinforcing the priority of form and process over content. Readers who do track them down will find that the sonnets speak in a stilted, obscure language, a limitation necessitated by the dizzying formal requirements of the genetic cipher. Unlike a typical unidirectional cipher, the Xenotext "has to be meaningful both before and after decoding."[14] After teaching himself the Python programming language, Bök wrote a program to help him select a viable cipher, a process that involved the evaluation of either "hundreds" of ciphers[15] or "eight trillion ciphers,"[16] depending on who you ask.

While Susan Vanderborg bravely develops a detailed analytical reading of "Orpheus" and "Eurydice," most of the scholars and journalists who have examined the Xenotext have largely glossed over the contents of the poems, focusing instead on the laborious audacity of the genetic engineering or on the conceptual puzzles involved in the attempt to create an eternal poet-host that is both living and, in a sense, mechanical, having no say over its own genetic replication. Should they survive into deep time, the

ultimate value of the sonnets may be expressed primarily in their implicit statements about twenty-first-century genetic engineering, cryptography, and ambivalent creative ambition rather than through the wording of the poems. One thinks of the Rosetta Stone, an artifact of immense value as a fount of historical insight, but whose contents (something about Egyptian political infighting) are of sustained interest to only a handful of specialists.

Even though they tend to focus on form over content, analytical readings of Bök's project have identified problematic ideologies within the process of genetic and poetic manipulation. For Andreae Callanan, the Xenotext is particularly troubling when considered from the perspective of its imposed gender roles. The feminine poem "Eurydice," after all, seems to exist merely to respond to its primary masculine counterpart. "The molecule," Callanan observes, "isn't actually able to 'read' and 'reply' in any real sense: its reply is crafted, engineered, determined by Bök. In Bök's scenario, the 'feminine' response is only a success if it tells him what he wants to hear, and what he wants to hear are the words he has written for the female speaker to tell him. There is no actual dialogue, and the suggestion of a masculine and feminine exchange is illusory."[17] In this sense, the Xenotext could be understood as a manifesto that will reinforce the patriarchy until the sun explodes, making Bök's self-made status as the poet whose project will live for all time a troubling proposition.

However we understand this form of creativity, its very existence depends on the hijacking of another species. What the Xenotext really preserves, what it really makes resilient, is the initiative of late-modern technoculture to use, and even

reshape, other forms of life for its own purposes. With the Xenotext, we become resilient (if only conceptually) by taking another creature's resilience and using it for ourselves. Science fiction writer Douglas Adams used to tell a joke about this behaviour. Speculating about why human beings have become dominant across so many different parts of the earth, he notes that humans are essentially a species of thieves. If a human being "arrives in a colder environment and sees an animal that has those genes which favour a thicker coat, he says, 'I'll have it off him.'"[18] The Xenotext turns *D. radiodurans* into a victim both of theft and of forced smuggling; the project imposes its own form into the bacterium even while it commandeers the animal's resilience. Vanderborg observes that Bök's project creates "artistic rearrangements of nature in service of human commemoration."[19] Or, in John Charles Ryan's words, "Despite such assertions for a kind of bioengineered bacterial voice through verse, the source text will always be predetermined by the human author."[20]

What greater act of appropriation could there be than the modification of an organism's genetic code in order to preserve a distinctly human initiative for all time? One logical conclusion of the Xenotext project would be for the author-geneticist to identify the particular genes that give *D. radiodurans* its ability to survive the harshest conditions, and to insert this code into human bodies, whose poetry could then live forever. The Xenotext is a Shakespearean germ that embodies both the triumphs and the failings of the famous bard, and indeed of all literature; its words, incredibly, may last effectively forever, yet its value is very human, very fragile and conflicted, and its frozen voice can only speak to those who are alive to hear it.

REVENGE OF THE GHOSTS

The story of natural time and cultural time is, in many ways, a ghost story. As we encounter the echoes of the past, and as we face the perpetual traces and shadows that we are leaving behind for the future, we must come to terms with ourselves as both the haunted and the haunting. Our role as spectres intertwines with the activities of other parts of the ecosphere, yet humanity promises to become a particularly stubborn apparition, echoing through the depths of time.

While Bök's Xenotext sees a nearly indestructible bacterium as a conduit to the deep future, our own present time is already the deep future for ancient bacteria that have rested, frozen in ice, for untold ages. Unsettlingly, some of these unknown microbes seem to be nearly as resilient as *D. radiodurans*. As Jasmin Fox-Skelly writes for the BBC,

> In a 2005 study, NASA scientists successfully revived bacteria that had been encased in a frozen pond in Alaska for 32,000 years. The microbes, called *Carnobacterium pleistocenium*, had been frozen since the Pleistocene period, when woolly mammoths still roamed the Earth. Once the ice melted, they began swimming around, seemingly unaffected.
>
> Two years later, scientists managed to revive an 8-million-year-old bacterium that had been lying dormant in ice, beneath the surface of a glacier in the Beacon and Mullins valleys of Antarctica.[21]

Ancient infectious viruses have also been revived in a similar fashion.[22] While scientists may be able to revive these life

forms in carefully controlled conditions, no such controls exist where ancient ice is melting, drop by drop, as a result of the warming climate. And, as Fox-Skelly points out, this process of microbial revival can be accelerated when mining or oil companies drill through ancient ice made newly accessible by the increasingly traversable Arctic seas. The reanimation of these alien microbes depends on their own natural ability, but their circulation through present-day ecosystems comes about through human activity.

In some cases, we are the ones who precariously entombed the bacteria in the first place. A recent study shows that "as a consequence of permafrost melting, the vectors of deadly infections of the 18th and 19th centuries may come back, especially near the cemeteries where the victims of these infections were buried."[23] Numerous anthrax infections have broken out in parts of northern Russia where infected cattle are buried,[24] a worrying process that involves the human domestication of animals, the physiology and ecological role of the cattle, the agency of the bacteria themselves, and human decisions about the handling of infected carcasses. This also raises concerns about the 1.5 million deer that died from anthrax a century ago in the same region.[25] Like demented spirits materializing over and over again, these microbes will not go away, and people find themselves intertwined in these events as both perpetrator and victim, participant and bystander. For humans, this is resilience of the wrong kind—a dark resilience that is both familiar and alien.

The problem goes beyond bacteria and viruses. During the Cold War, the U.S. military constructed a base in Greenland to test their ability to launch nuclear missiles from the

site. It was taken for granted that the camp would be buried forever under many centuries of snowfall, and therefore, upon its deactivation in 1967 it was abandoned without any proper disposal of its two hundred thousand litres of diesel fuel, low-level radioactive coolant, and, perhaps most worryingly, polychlorinated biphenyls: notorious carcinogens and neurotoxins that bioaccumulate within contaminated ecosystems.[26] The assumption that the site would remain frozen now seems hopelessly naïve. Current estimates suggest that the camp will resurface from the thawing ice by the end of the century or sooner, and this site is merely one of many.[27] Like the inadequately buried cattle, this misdeed reaches into the past, troubles the present, and haunts the future.

These forms of dark resilience play just a small part in what will become the effectively unending presence of the modern age, which promises to haunt the earth into the depths of time. This notion is most popularly understood in terms of the Anthropocene, the proposed present geological epoch characterized primarily by human impacts on the ecosphere. The question of when the Holocene—the period of stable climate following the last ice age—gave way to the Anthropocene has been much discussed, but the currently favoured choice is around the year 1950, when the radioactive detritus of nuclear detonations became scattered across the planet. This more or less coincides with other factors that have been proposed as markers of the Anthropocene, including "plastic pollution, soot from power stations, concrete, and even the bones left by the global proliferation of the domestic chicken."[28] All these fragments, of course, are merely markers. The more significant changes that we have brought about within the ecosphere consist of the obvious

list: widespread extinctions, global warming, sea level rise, acidifying seas, and the radically altered character of much of the land surface of the planet. We create 1 million plastic bottles per minute, and by 2050 the oceans may contain more plastic by weight than they do fish.[29] The figures along these lines go on and on.

The forms of waste that serve as testament to the Anthropocene are creating a clearly defined and perhaps irrevocable layer within the geological crust of the earth, a truly mind-bending proposition. Michelle Bastian and Thom van Dooren observe that

> while the fear of capricious immortals living high atop Mount Olympus may have waned, the current age of the Anthropocene appears to have brought with it insistent demands for we mere mortals to once again engage with unpredictable and dangerous beings that wield power over life and death. These "new immortals" such as plastics, radioactive waste and chemical pollutants have interpellated us into unfathomably vast futures and deep pasts, with their effects promising to circulate through air, water, rock and flesh for untold millions of years.[30]

As they try to make sense of a world where mortal humans live alongside dangerous immortal presences of our own creation, Bastian and van Dooren find that "thinking through the Anthropocene requires much more of us than a simple 'zooming out' to explore the larger scales of spacetime often associated with 'the geological.'"[31] New forms of imagination,

they suggest, are necessary to comprehend the absurd incongruity of temporary life and its permanent waste.

Bastian and van Dooren's notion is deeply suggestive. Like Ares, Artemis, and Hades, the new immortals serve as conceptual tools through which it is possible to view humanity from an illuminating perspective. Like the ancient gods, the new immortals provide an explanation for the chaos of the world and the cruel volatility of nature. Unlike the Olympians, though, the new immortals have established a permanent presence within objective reality and will continue to give form to the world long after the demise of human beliefs and ideologies. In ancient Greece, it was the Titan Prometheus who created humankind, a myth that finds its curious double in the fact that it was humans, of course, who created Prometheus. A similar duality exists with the new immortals—they are objects of our creation, yet they also bring into existence the very identity of humankind as geological force, and they will continue to create this human ghost effectively for all time. The new immortals create us, forever, out of the dust of the earth and the bones of chickens. We have finally seen the face of God, and it is a layer of plastic and concrete.

In his comments about the distant future, David Farrier, a scholar of literature and deep time, writes that "the need to imagine deep time in light of our present-day concerns is more vital than ever. Deep time is not an abstract, distant prospect, but a spectral presence in the everyday. The irony of the Anthropocene is that we are conjuring ourselves as ghosts that will haunt the very deep future."[32] The plastics and concrete, the isotopes and chicken bones with which we have built an effectively permanent layer into the geological

record are the medium through which we will gain a figurative and unsettling immortality. Each of these forms of detritus inevitably calls to mind the species that created them, forging a symbolic chain that stretches more or less to eternity. These immortal figures, then, are not only a form of deity but also a form of language, a series of metaphors that make clear the conceptual links between humanity, industrial capital, petroleum, and the insatiable hunger that lays waste to the biosphere in much the same manner as the impact of a comet. This, then, is the shadow beneath Bök's statement that "few imagine that we might write poetry capable of outlasting the existence of our species."[33] Such poetry has already been written. We are the authors of chicken bone geology, and the Xenotext, in a sense, is redundant.

In Buddhism, a person who carries out destructive acts within the realm of desire may be forced to linger, after the death of their body, as a "hungry ghost," a presence whose appetite can never be satiated.[34] Those societies that have sought endlessly to sate their voracious ecological appetites are the hungry ghosts that haunt both the present and the future. And through this haunting, we conjure the greatest hungry ghost of all, the epoch that bears our name.

HAUNTING STORIES

There is another kind of ghost that human beings have great expertise in conjuring, and to this ghost we give the name of stories. Narratives of all kinds can be understood as trembling glimmers of times past and times to come, of imaginative realms beyond what is known and visible. For Margaret Atwood, whose book on the subject is titled *Negotiating with the Dead*, the writing process is a form of communication

between the seen and the unseen, between that which is present and that which is ghostly.[35] This spectral negotiation then results in the tangible but strange product of the narrative. That which is narrated never truly shares its identity with mundane reality, yet it unmistakably echoes and distorts what is familiar, at once carrying a message about the world and constituting a form unto itself. Regardless of whether they are "true," stories float, nearly invisible, in front of our eyes, bending and shaping our visions of what we thought we knew.

Julian Wolfreys asserts that "to tell a story is always to invoke ghosts, to open a space through which something other returns, although never as a presence or to the present."[36] The contradiction in this statement turns on the fact that while the story belongs to present reality, its contents never quite materialize, a paradox that also informs Colin Davis's explanation of "the figure of the ghost as that which is neither present nor absent, neither dead nor alive."[37] Wolfreys continues, "all stories are, more or less, ghost stories. And, to reiterate another principle: all forms of narrative are, in one way or another, haunted."[38] One explanation for the persistence of narrative across all domains of human experience has to do with the fact that consciousness is an inherently murky realm in which the realities of social and physical experience are never simple realities but are inevitably given form through hazy conceptual links and shared figurative associations. Our world is somewhat ghostly to begin with, and narrative is the force, sometimes visible, sometimes hidden, through which the instability of the world is both resolved and revealed as unresolvable.

Given all of this, we should hardly be surprised that narrative and its related processes of meaning-making are

uniquely positioned to help us understand and even reformulate our ghostly ecological experiences, since we are, so to speak, the naturally haunted and the naturally haunting. We are now far beyond any possibility of vanquishing the shadows that humanity will cast on the depths of time, but our inevitable need to form and reform the narratives with which we live—a need that is closely linked to what Jeffery Donaldson calls "the metaphoric initiative"[39]—can recast these shadows under new forms of light. This is not a wholly conceptual exercise, because the stories within which we carry out our existence in these crucial early days of the Anthropocene may shift the human forces that will resonate for ages.

In her poetry volume *undercurrent* (2015), Rita Wong examines the relationships between modern culture, heavy industry, consumerism, ecology, and indigeneity. Her poem "Q'élstexw" suggests that the city of Vancouver remains haunted by what it has both literally and figuratively paved over. The title of the poem means "to return it, give it back" in Halq'eméylem, the Upriver dialect of the Halkomelem Coast Salish language, belonging to the Stó:lō Nation of the Fraser Valley whose traditional territory includes what is now the city of Vancouver.[40] The poem begins,

> *the city paved over with ~~cement~~ english cracks open, stubborn*
> Halq'eméylem *springs up*
>
> *among the newspaper boxes and mail receptacles in the shade of the* thqa:t
>
> *along the sidewalks lined with grass and* pta:kwem *waiting to grow*
> *anywhere they can*[41]

Language becomes a central concern in the poem, both in the startling appearances of the Halq'eméylem language and in the way that the poem develops an English that seems subverted and ineffectual as it buckles and breaks. The replacement of the word *cement* with *english* likens the language of colonization to an infrastructure that conceals and suppresses both the landscape and its Indigenous cultures. Yet this is an infrastructure that has started to fall apart even as the poem has barely begun: the lack of a capital letter at the beginning of the sentence, the second-guessing of the strikethrough over the word *cement*, the use of the lower case for *english*, and, of course, the first active verb in the poem, the cracking open of the language—all these elements dismantle the self-assuredness of the colonizing process.

Meanwhile, the Halq'eméylem language becomes the weed, the persistent life that disrupts the suppression caused by the English pavement. Halq'eméylem words "invade" the poem by popping up in the middle of the English sentences, so that the everyday business of the city is interrupted by *thqa:t* (tree), *pta:kwem* (bracken fern), and other words throughout the poem. However, the English words are italicized as though *they* belong to a foreign language, while the Halq'eméylem words claim the upright typeface of standard discourse. Who, then, is invading whom? Or, we might say, who is the haunting and who the haunted? The poem creates the sense that the Halq'eméylem language and the plants and animals that have been suppressed play the role of invader at the same time they represent the true ecology of the place. The urban ecology of the city is one in which previous layers of time remain perpetually

present, disturbing the supposed singularity of pavement, newspaper boxes, and English. One might be reminded of another poetry volume, *Thirsty*, in which Dionne Brand sees in Toronto "the cramped dirt, the broken / air . . . / the plastic throats, the perfumed garbage," and then remarks that the city is "the feral amnesia of us all."[42] If a city is characterized by the rampant urge to forget, by its ability to construct itself through acts of smothering, literature can recover what is forgotten, showing that the life underneath has never disappeared.

A few years before completing *undercurrent*, Wong published an earlier version of "Q'élstexw" in an anthology of Canadian ecological poetry. This earlier version of the poem was titled "Return." By adopting the Halq'eméylem word for the later version of the poem, Wong pushes the process of decolonization a little further, both in the sense that the Halq'eméylem language has "returned" to prominence and in the sense of "giving it back." An ambivalence exists here in Wong's position, in that she fosters a return of indigeneity yet also occupies an uneasy position as a member of the settler society, a situation that is further complicated by the fact that she herself is a person of colour. This precariousness often becomes a conscious focus in her writing, and Wong refers to herself as an "(un)settler" in recognition of the quandary. Gillian Roberts notes that "Wong's term '(un)settler' works to invoke the position of settler while acknowledging the ambivalent position of racialized Canadians with respect to colonization in Canada and alluding to her efforts to work as an ally to Indigenous peoples."[43] The expression of time in "Q'élstexw" is not a simple matter of returning to a previous state of indigeneity and ecology, but

instead speaks to the complexities of a city in which many different temporalities intersect, confront, and reshape one another, a problem to which the poem and the society in which it exists must return and return again.

Concrete is not just the stuff that colonized cities happen to be made of. As we have seen, it is an emblem of the Anthropocene. As indigenous plants and words break up the cement of the city in Wong's poem, they seem to suggest that, like colonization, the Anthropocene is not invincible. The process of decolonization is also the beginning of the fantastic and necessary process of dismantling the Anthropocene. When Wong was incarcerated in 2019 for blocking the Trans Mountain pipeline, she was sent to a prison made of concrete, and the statement she provided upon being sentenced (which I refer to in Chapter Three) might be said to conceptually crack open the colonial judicial system and its infrastructures by invoking a long view of time and the priority of Indigenous presence. My position in writing these words from an office is all too comfortable compared with the long days Wong spent in prison, but it is important to recognize and tell the story of her work. None of the above projects will "return" the world to the way it used to be; resilience is always shadowed by the disruptions that it has been forced to overcome, and the Anthropocene is no small disruption. Wong's work implies, though, that colonization and its larger spectres can be resisted and chipped away through the everyday work of rewriting the land and its expressions of time. The cement does not disappear, but it cracks open enough to let some light in.

EVEN WHILE THE forces of the Anthropocene can in some ways be resisted, discussions of the Anthropocene and deep time inevitably involve thinking about extinction. There is some debate about whether we have actually now entered a sixth mass extinction in the history of the earth, and about whether the Anthropocene truly deserves the title of geological epoch.[44] These are still early days and much remains to be seen. The path of rampant carbon emissions, though, is one that the earth has travelled before, and the destination is not good. In his study of the major mass extinctions in the fossil record, Peter Brannen notes that "the five worst episodes in earth history have all been associated with violent changes to the planet's carbon cycle."[45] If we thoroughly overheat the earth, "the planet will return to a condition that, though utterly alien to us, has made many appearances in the fossil record."[46] To imagine what such a condition might look like, we can picture the world after the End-Permian extinction: a planet characterized by millions of years of "microbial slime."[47] Brannen's use of the word *return* to describe the reappearance of a world drenched in carbon dioxide might catch our eye after reading Rita Wong's poem. Like the notion of resilience, the prospect of returning to past conditions seems both unworkable and unavoidable, and it can invoke both hope and fear. Thankfully, Brannen stresses that our present situation is not a simple repetition of the earlier forms of mass death. Our moment is unique, and up to this point "we have not produced anything even *close* to the levels of wanton destruction and carnage seen in previous planetary cataclysms."[48]

What kind of lens, if not poetry, can shape such mind-bending thoughts into coherence? I will end here with

a poem by Di Brandt, called (take a deep breath) "Optimistic thots on the incidence and value of mass extinctions in the development of intelligent life on our beautiful planet now in such dire peril." She writes,

> Mass extinctions tend to happen only once in 100 or 200 million years.
>
> Not everything gets wiped out, a small remnant of plant and animal life survives.
>
> The earth is capable of radical renewal after nearly complete global cataclysm in the relatively short period, geologically speaking, of 10 million years, astonishing when you think it took billions of years to develop to that point.
>
> The earth's magnificent renewal after cataclysm becomes the occasion for dramatic new speciation and proliferation of never before seen extravagant lush extraordinary life forms.[49]

Finally, we can breathe a sigh of relief. The earth takes a mere 10 million years to renew its biosphere after global collapse, producing beautiful new forms of life. The 10-million-year view offered in this poem is both earnest and ironic: earnest because it helps us to realize that humanity does not lie at the centre of time any more than the earth lies at the centre of the universe, and ironic because it slyly waves aside the fact that our actual present-day survival is pretty important to us. As human beings with human concerns, we probably cannot focus in a sustained way on the

poem's incredible span of time, yet the possibility of doing so is enchanting. The title of the poem, too, is both absurd and hopeful, a handkerchief pulled from a magician's sleeve, an unravelling string that promises a small moment and then, to our delight, refuses to come to an end.

It does come to an end, of course. In the closing section of the poem, Brandt speculates about which "evolutionary seed," which wishes, habits, and memories we would like to leave behind, or take with us, into the next 10 million years, an imaginative game that might be called the final question of human narrative. In his comments on deep time, David Farrier observes, after the geologist James Hutton, that "humans live enfolded by deep time. It leaves its impression upon us, and we impress upon it our anxieties, our inventions, our desires."[50] Brandt's poem gives form to the notion that the terrible beauty of our rewriting of the earth's history, our potential ignition of mass extinction, our nuclear isotopes and chicken bone geology, all fling themselves far beyond the horizon of human time, thus expanding this horizon before our eyes and reflecting it back to us anew.

All of this calls to mind, perhaps, the painstaking study of the collapse of civilizations carried out by famed scholar Jared Diamond. After surveying the reasons behind the collapse of societies such as Easter Island, the Classic Lowland Maya, and Norse Greenland—and then comparing these disasters with societies that have survived intact for many centuries—Diamond concludes that "two types of choices seem to me to have been crucial in tipping their outcomes towards success or failure: long-term planning, and willingness to reconsider core values. On reflection, we can also recognize the crucial role of these same two choices for the

outcomes of our individual lives."[51] While Diamond does consider the role of dangerous cross-cultural encounters such as the arrival of Europeans on Easter Island, as well as ecological factors beyond human control, his conclusion tends to de-emphasize imposed forms of carnage such as colonization and its diseases, focusing instead on the role of agency and choice. The edge of collapse is a position from which the production of wishes and memories becomes all-important.

I won't try to resolve the historical issues raised by Diamond's study, but one response to this problem would be to observe that the need to re-evaluate choices must extend to those actions that could harm the agency of others. In the case of our own society, the "others" in question are not only those who have already been marginalized but also the many diverse inhabitants (human and nonhuman) of the times to come. Given the fact that literary texts, as Catriona Sandilands observes, contribute "to an environmental public culture,"[52] we could do worse than look to the poetry of decolonization and the poetry of deep time to reconsider our collective approaches to long-term planning and the evolution of core values. By giving imaginative voice to experiences that unfold across different times—different moments and years that cannot yet be seen directly—literary reflections on the future illuminate a form of otherness that many other discourses render invisible. The forms of experience that will exist fifty or five hundred years from now—some of which will actually be our own experiences, just later, and many of which will belong to others—will not be the same as our experiences today, and they deserve recognition. Alongside discrimination based on gender and race,

modern society risks disempowerment of people and other creatures who exist across many different future moments. A good poem or story, a good wish or memory, can expand our awareness of diversity and inequity to account for time as a vital form of difference.

Ursula K. Heise has argued that discussions of endangered species do not reflect a pure or objective form of inquiry into the nonhuman. Rather, such discussions "gain sociocultural traction to the extent that they become part of the stories that human communities tell about themselves: stories about their origins, their development, their identity, and their future horizons."[53] Likewise, while discussions of the mass extinctions in the earth's ancient past can serve as a partial escape from a focus on humanity, the escape can never be total. And yet, this limitation is something we can embrace. Such discussions settle into our consciousness, causing us to reflect differently on our priorities, our future, and our place within the larger flow of time. By imagining a world far removed from the human moment, Brandt's poem enables a return to the matter of human priorities in the form of the wishes we might make for a future that might not include us. The poem suggests that every desire or anxiety we have about the future intimately shapes that future and that this knowledge thus reshapes our own time, a striking and potentially more hopeful example of the principle identified by Susie O'Brien and Cheryl Lousley, that "imagined futures help to structure and organize social relations, often solidifying and legitimizing existing inequalities in the process."[54] Taking part in Brandt's imaginative exercise about selecting the wishes and memories that will shape the world for millions of years may be a form of

long-term planning that can modify the core values it draws from. Our concerns lie within our own human moment, an intimate present inflected with the beauty and the terror of expanded time.

IN HIS MUCH-ANTHOLOGIZED essay "Why We Crave Horror Movies," Stephen King tells us that we seek the dark pleasures of cinematic terror and blood because they satisfy the most depraved impulses that lie, always in wait, alongside the more admirable strands of our emotional muscles. King sees horror movies "as lifting a trap door in the civilized forebrain and throwing a basket of raw meat to the hungry alligators swimming around in that subterranean river beneath."[55] Keeping the alligators fed, he advises, stops them from getting out. In the era of global heating, King's alligators of our secret craving for blood have now been joined by the alligators of the Arctic swamps, ghosts that lurk within the future we have begun to conjure, haunting the mind as we go about our lives.[56]

If we do not want the alligators of the Arctic swamp to escape, to wreak their havoc on the actual earth, we have to keep them fed, as it were. Unlike King, who cages the alligators of his mind by giving them horror movies, we have been failing to feed the Arctic alligators and all the other ghosts of the Anthropocene. We have buried them in the dark recesses of our civilizational mind, and because of this we risk letting them fester and escape. To keep them fed, to keep them in that dark, imaginative realm where they cannot unleash their most terrible harms, perhaps we need to find the ecological equivalent of watching a horror

movie. Only by contemplating the story of civilization that would lead us straight to the alligators can we then choose a story that leads somewhere else. Unfortunately, we have not done this. The real world is starting to turn into an ecological horror show, and the slope into the alligator pit has now become very slippery indeed. Would Stephen King still advise us to watch horror movies if they were documentaries, or if the terrors they foretold were all but inevitable?

If the narratives of the Anthropocene are making their way into the nonfiction section, then we have all the more reason to read them carefully. Our best hope is that seeing the early stages of collapse with our own eyes will inspire us to prevent the later stages; this is also our biggest challenge, because when it comes to climate change and ecosystems, the narrative path between action and consequence is characterized by long lag times and sudden spasms. The destructive human influence on the ecosphere may never be erased altogether, but the way we imagine and enact the forms of time that distinguish our era remains pliable. If the Anthropocene is made of cement, then thoughtful narratives are the weeds that crack the sidewalk, an initiative both hopeful and hopeless that fights resilience with resilience. The stories of the Anthropocene, and the forms of time emerging from them, will shift from earnest to ironic, haunted to haunting, and back again.

THE CLOCK'S WOUND UP

When a crisis of time is unfolding before our eyes, any discussion of time is always political. And every discussion, in a sense, is a discussion of time. Every narrative, every object, every living thing is a clock, each one crucial and incomplete, beautiful and broken in its own way. Telling the time is no longer as simple as glancing at the clock on the wall, if it ever was that simple. To tell the time is to stake out a position, to declare an investment in the values reflected by one clock over another, an act that shapes the future in all its inequities and promise.

All of this is perhaps an exhausting prospect. We need only think back to the coral reef, that delicate ecosystem that is counting down toward its own collapse, and to the people who live alongside it. Ed Yong, a writer for *The*

Atlantic, has observed that the prolonged sight of dying reefs is devastating for the mental health of coral reef biologists, recovery experts, and the millions of people whose way of life depends on coral. "How do you get up and go to work every day," he writes, "when every day brings fresh news of loss? When everything you are working to save is collapsing, how do you stop yourself from collapsing, too?"[1] How do we move on from here? What is our next step?

Earlier in this book, I considered depression and creativity as two possible responses to the ecological crisis of time. Ultimately, our response will not be a choice between these two poles. We can, and probably must, choose both. Either one on its own would be too certain, too blind to the evidence, too incomplete. The limitations of creativity can bring about despair, yet the process of engaging with despair creates a way forward. As Ashlee Cunsolo and Karen Landman observe, "mourning can unite, and grief over a shared loss or something integral to one's self can be a powerful political motivator and unifier."[2] Literature and other imaginative responses can help us engage with the reality and the urgency of both depression and creativity. The skills of careful reading can open our eyes to the politics of time, a vision filled with terrors and possibilities.

One last metaphor can illuminate this point. Don McKay's poem "Waiting for Shay" takes place in the wilderness of British Columbia's coastal forest, and it contemplates the sudden arrival of the Shay locomotive, a train engine that was used widely on Vancouver Island in the first half of the twentieth century to haul timber out of the forest.[3] For McKay, the arrival of the engine as it floats up to the shore on its barge is the arrival of modern progressive time within

the wilderness. The presence of the engine transforms its surroundings, replacing the temporality of leaves, moss, and bears with the Western framework of linear progress, rapid development, and the countdown toward extinction.

Shay is a marvellous invention. "Engine, ingenuity," McKay writes: "how could we not love it?"[4] But Shay is also a terrible, violent machine, a mechanical ambassador for modernity's most destructive values, and it converts the forest into a collection of living resources to be killed and harvested. The poem ends with these lines:

> When the barge arrives the sleeping shape
> will wake and start to breathe and
> build a head of steam, accumulating wrath
> like a hell-fire preacher. Then,
> in a series of sharp
> expostulations—work work work—
> crank itself ashore. And then
> the clock's wound up.[5]

The temporality of the forest thus completes its transition to modern time. The wound-up clock is both the mechanical "clockwork" of the Shay engine and the countdown to the destruction of the forest through logging; the measured pace of time and the condition of mortality have begun to tick for the forest along with the "work work work" of the machine. Shay becomes the engine of death, and we, along with the forest, await the enactment of its (and our) inevitable task.

Importantly, we become implicated in these events not only generally as members of modernity but specifically as readers of the poem. To read these lines is to participate,

at least conceptually, in the creative process by which the deadly clock winds up. In this way, the poem confirms our status as temporal colonizers who are simultaneously in love with, blind to, and horrified by our own cultural ideologies of time.

And yet, the final image of the poem, the wound-up clock, implies not only doom but also potential. A clock with a tightened spring is poised, anxious to expend energy, aching to bring a particular form of temporality into the world. The wound-up clock is the countdown toward extinction, but it is also the confirmation that the end has not yet occurred and that there is still opportunity to act, to intervene, to deploy time in creative ways. It is an image of urgency and readiness. Like the wound-up clock of the earth, the clock in the poem is both depression and creativity, despair and hope.

A good poem can help us experience the world as though for the first time, allowing us to see beyond the time socialization stories we live by. Nevertheless, poetry remains just one of many kinds of texts that have something to teach us. Commenting on the complex possibilities of many different forms of representation, Daniel Coleman suggests that "we need to read texts that are smarter or wiser than we are on our own" and that doing so requires attention to variety and detail rather than the assertion of rigid literary boundaries.[6] Indeed, the distinction between representations that prop up dangerous assumptions about time and those that question such assumptions is often not clear-cut. Energy policies, news articles, advertisements, and novels all circulate within the deep and roiling ocean of ideologies of time. In enabling us to read, evaluate, and reshape the visions

of time embedded within all forms of cultural and literary narratives, ecocritical time studies plays an important role in the projects, now inevitably intertwined, of cultural analysis and ecological survival. As we encounter the diverse stories that surround us, we must recognize those moments when a text has something to teach us about natural and cultural time, and we must also embrace those moments when we need to become the teachers. A critical eye that moves freely back and forth between one form of representation and another is well positioned to embrace the complexity of these seemingly routine encounters. This is what it means to have an everyday literacy of the temporal imagination.

Narratives, like clocks, are political and malleable, artisanal and ordinary. They can govern our lives without us really noticing. The essence of narrative is that it structures time, and if we are going to think critically about time, we need to think critically about narratives. As the world groans and crumbles, as new life and creative energies spring forth, one thing remains constant: every story is a time socialization story. Every narrative has something to say about our encounters with time, and the process of thoughtful reading can discern which forms of time might hold together in a diverse and fragile world. Every story is a clock, and we must tell the time every day.

INTRODUCTION: NATURE'S BROKEN CLOCKS

1 Huebener, *Timing Canada*, 20.

2 Currie, *About Time*, 111.

3 Banting, "Suddenly."

4 Zeebe, Ridgwell, and Zachos, "Anthropogenic Carbon Release Rate," 325.

5 For the thirty-year figure, see "Scientists Race." On the heat waves in the Great Barrier Reef, see Meyer, "Since 2016."

6 Sheppard, Davy, and Pilling, *The Biology of Coral Reefs*, 278.

7 "Scientists Race."

8 The facts and quoted passage in this paragraph come from Reid and Nunn, "Ancient Aboriginal Stories."

9 Kolbert, *The Sixth Extinction*, 128.

10 Kolbert, 128.

11 The details in this paragraph are drawn from a number of sources. On the origins of limestone, see "Limestone"; on the erosion of caves, see Pogson, "Limestone Caves"; on the pyramids, see "Pyramids of Giza"; on concrete, see "Missouri Limestone"; on toothpaste, see "Limestone in Your Everyday Life"; on Kingston, see "History"; on petroleum, see "Evaporites"; on bread, see "Limestone in Your Everyday Life."

12 "Scientists Race."

13 "A Coral Reef Revival."
14 Alice Klein, "Divers Are Attempting."
15 Jones, "Researchers Accelerate Evolution."
16 Jones.
17 While assisted evolution aims to speed up the corals' clock, geoengineering projects seek to slow down the pace of global warming itself. A group of scientists in Sydney are examining what they call "cloud brightening," a process that would involve spraying salt particles into the sky above the reefs, spurring the formation of new water droplets. The result, when applied at a massive scale, would be bigger, denser clouds that "should reflect more heat back into space" (Temple, "Scientists Consider Brighter Clouds"). Whether such a project would actually work is not known. Even if it does work, it would merely buy time, masking the true effects of global warming only in the targeted area and only for as long as the seeding process continues. Ultimately, the warming will catch up.
18 Rosa, *Social Acceleration*, 21.
19 "5 Facts about Leap Year."
20 Lakoff and Turner, *More Than Cool Reason*, 50.
21 Lakoff and Turner, 35–46.
22 Donaldson, *Missing Link*, 188.
23 Donaldson, 3. Donaldson's remarkable book posits a profound relationship between metaphor and physical reality, the ultimate foundation for all of nature. He considers "how the experience of paradoxical relation—an *is* and an *is not*—may be traced back to a time before the advent of mind, before language and its inherent structures of relation, back through evolution, through DNA, through chemistry to the origins of matter."
24 Bartlett, "Time, Flying," 115.
25 Bartlett, 115.
26 Birth, "While the West Sleeps," 110.
27 Sharma, *In the Meantime*, 9.
28 Sharma, 79.
29 Sharma, 137.

30 Rob Nixon's work, which I will discuss later on, is largely compatible with Sharma's study, but it focuses on environmental injustice. In particular, he shows that poverty is central to understanding the "slow violence" of long-term environmental destruction, because "it is those people lacking resources who are the principal casualties" (Nixon, *Slow Violence*, 4).

31 L'Abbé, "LXXXI," 29.

32 The links between race and ecological disaster extend in many directions. As the Black Lives Matter activist Alexandra Wanjiku Kelbert explains, "it is communities in the global south that bear the brunt of the consequences of climate change"; for this reason, "the climate crisis is a racist crisis" (Kelbert, "Climate Change"). Alongside L'Abbé's warning that racism can forestall action on climate change, Kelbert's comment suggests that racial injustice and climate change risk becoming mutually reinforcing.

33 On the role of industrial agriculture in ecological collapse, see Monbiot, "Insectageddon."

34 Moore, *Anthropocene or Capitalocene?*

35 McBrien, "Accumulating Extinction," 119.

36 On Indigenous experiences, see Ostapchuk et al., "Exploring Elders' and Seniors' Perceptions." On poverty, see Nixon, *Slow Violence*.

37 Blatchford, "Hurricane Matthew."

38 Adam, *Timescapes of Modernity*, 9.

39 Bastian, "Liberating Clocks," 42.

40 Bastian, 41.

41 Bastian, 42.

42 For some of these key points, see in particular pages 44, 49, and 50 in Bastian's "Liberating Clocks."

43 Bastian, "Fatally Confused," 31, original emphasis.

44 Bastian, 41.

45 Bastian, 44.

46 Bastian, 44–45.

47 "Device."

48 Ricoeur, *Time and Narrative* vol. 1, 3.

49 "Critical time studies," I have suggested elsewhere, is "a process of inquiry that advances thoughtful re-evaluations of the social politics of time through the examination of temporal assumptions and the fostering of critical temporal literacy" (Huebener, *Timing Canada*, 14). By honing our ability to read time critically, we can understand how time operates socially as a form of power, and we can recognize that "imaginative responses are key to understanding and questioning this power" (Huebener, 14).

50 In a brief survey of certain theoretical works on time and the environment, Erin Fitz-Henry speaks of a "growing interdisciplinary consensus about the imperative of thinking more carefully about the timescales within which to understand the depths of the current environmental crisis" (Fitz-Henry, "Multiple Temporalities," 2). Alongside the matter of timescales, I also wish to emphasize the many ways in which time operates as a form of power.

51 Sharma, *In the Meantime*, 142.

52 Ingold, "The Temporality of the Landscape," 159.

CLOCK ONE: THE EARTH

1 The facts and quoted passages in this paragraph come from Brumfiel, "New Clock."

2 Adam, "Perceptions of Time," 512.

3 Landes, *Revolution in Time*, 3.

4 Brumfiel, "New Clock."

5 Varkaris and Connell, *Early Canadian Timekeepers*, 42.

6 Dohrn-van Rossum, *History of the Hour*, 346.

7 McKay, *Deactivated West 100*, 30.

8 Varkaris and Connell, *Early Canadian Timekeepers*, 9.

9 Varkaris and Connell, 115.

10 Dohrn-van Rossum, *History of the Hour*, 346.

11 Dohrn-van Rossum, 346.

12 Birth, *Objects of Time*, 2.

13 Dewdney, *Soul of the World*, 36; Thomson, *The Beginning of the Long Dash*, 169.

14 Howe, "To the Town Clock," lines 14–21.
15 Varkaris and Connell, *Early Canadian Timekeepers*, 37–38.
16 Howe, "To the Town Clock," lines 79–84.
17 Stewart Brand, *The Clock of the Long Now*, 66.
18 Lampman, "The Railway Station," 240.
19 Landes, *Revolution in Time*, 229.
20 Barrows, *The Cosmic Time of Empire*, 43–45.
21 Flynn, "The Railway in Canadian Poetry," 73–74.
22 Genesis 1:4, King James Version.
23 Flynn, "The Railway in Canadian Poetry," 79.
24 Lampman, "Heat," lines 17, 20, 15–16.
25 Lampman, lines 45–46.
26 Lampman, "The Frogs," lines 45–46.
27 Allen, *A Republic in Time*, 2.
28 Adam, "Perceptions of Time," 513, original emphasis.
29 Landes, *Revolution in Time*, 16.
30 Blaise, *Time Lord*, 103.
31 Levine, *A Geography of Time*, 89.
32 Levine, 75.
33 Soper, *What Is Nature?*
34 A scholar of environmental planning, Sabine Hofmeister has observed, for instance, that we inevitably take for granted particular visions of society, economics, and ecology whenever we engage with the thorny matter of "natural time-spans," ("Nature's Temporalities," 312).
35 "Rocky Mountain."
36 Ingold, "The Temporality of the Landscape," 168. Ingold uses the word *taskscape* to refer to the arrangement of land and time within which we exist; he asserts that "the temporality of the taskscape . . . lies not in any particular rhythm, but in the network of interrelationships between the multiple rhythms of which the taskscape is itself constituted" (160).
37 Ingold is one of a number of scholars and artists who have considered this notion from various perspectives. Timothy Morton uses the terms "concentric temporalities" and "fuzzy temporalities" (Morton, *Dark Ecology*, 69, 71) to describe the way that each

element of the ecosphere encounters and contributes to many forms of time that are nested within one another and whose boundaries are indeterminate and pliable. Or, in Marlene Creates's more poetic formulation, a single waterfall involves many different forms of time, from the fast flow of each droplet, to seasonal variations in the volume of water, to the slow erosion of the rock (Creates, "From Landworks").

38 Wood, "Time, Cycles and Tempos," 273–75.

39 Dewdney, *Soul of the World*, 32.

40 "Caribou's Inner Clock."

41 "Caribou's Inner Clock."

42 Vogel, "Marching to the Beat."

43 Vogel.

44 Kolbert, "Greenland Is Melting." Also see Rob Wilder and Dan Kammen's article about climate inertia, in which they observe that "the world's oceans can be expected to continue rising for many thousands of years even after temperatures stabilize" (Wilder and Kammen, "Taking the Long View").

45 See also Daniel Gustav Anderson's efforts to contextualize ecocriticism within natural and cultural histories. He seeks "to frame a theory of temporality that specifies the location of the ecocritic in time" (Anderson, "*Natura Naturans*," 35). On a larger scale, Dipesh Chakrabarty notes that human societies evolved partially in response to global climate patterns, a process that now functions increasingly in both directions (Chakrabarty, "The Climate of History," 213).

46 Sharma, *In the Meantime*, 122.

47 For a nuanced perspective on many concerns related to food, the environment, and narratives, see Michael Mikulak's *The Politics of the Pantry*.

48 Urry, "Speeding Up and Slowing Down," 194.

49 Wersan, "The Early Melon," 283, 285.

50 Wersan, 285.

51 Wersan, 287.

52 Ricoeur, *Time and Narrative* vol. 2, 81.

53 See, for instance, Barbara Adam, "Perceptions of Time," 509 and 519. In her work on modern time and the environment, Adam also advances the notion of "timescapes" as a way to engage with temporal complexities: "Where other scapes such as landscapes, cityscapes and seascapes mark the spatial features of past and present activities and interactions of organisms and matter, timescapes emphasise their rhythmicities, their timings and tempos, their changes and contingencies. A timescape perspective stresses the temporal features of living" (Adam, *Timescapes*, 11).

54 Ricoeur, *Time and Narrative* vol. 1, 3.

55 McKay, *Vis à Vis*, 29. In her book *Imagining Extinction*, Ursula K. Heise takes another approach to the problem that ecosystems themselves might fade into the background insofar as cultural engagements with nature primarily reflect human concerns. She makes the point that studying cultural representations of endangered species "shows some of the crucial ways in which animals and, more rarely, plants and other organisms, are cultural tools and agents in humans' thinking about themselves, their communities, their histories, and their futures" (Heise, *Imagining Extinction*, Kindle location 190). The careful study of such cultural narratives is a form of thoughtful anthropocentrism.

CLOCK TWO: THE GROLAR

1 The details in this paragraph are drawn from Cain, "As Climate Warms."

2 Cain.

3 "Hybrid Bear."

4 Pope, *An Essay on Man*, lines 249–52.

5 Copway, *The Life*, 17–18.

6 Lyell, *Principles of Geology*, 87.

7 Kolbert, *The Sixth Extinction*, 24.

8 O'Brien, "Nature's Nation," 176.

9 Day, *Nevermore*, 174.

10 Day, 174. Recent research suggests that even the famously massive congregations of passenger pigeons that enabled the

occupation of the pigeon hunter did not represent a pre-existing natural stability; these giant flocks represented a sudden explosion in pigeon populations brought about by widespread colonial disruptions to ecosystems and Indigenous populations (Mann, "1491"). Before European colonization, Indigenous societies throughout the Americas managed the landscape in a much more extensive and systematic way than Western history has usually assumed (Mann). The disinclination of Western culture to acknowledge the massive infrastructures of Indigenous land use seems to be one way in which the West has dismissed Indigenous societies as merely "natural," in the sense of being unchanging and without history.

11 Kricher, *The Balance of Nature*, 23. Writing in the journal *Ecology Letters*, an interdisciplinary group of scientists similarly argues that while the discipline of ecology has usually developed insights by focusing on spatial aspects of the environment such as habitat loss, a new focus on "temporal ecology" should now be understood as a necessity, especially in considerations of accelerating climate change (Wolkovich et al., "Temporal Ecology," 1365).

12 Thompson, *Where Do Camels Belong?*, 3.

13 Thompson, 4.

14 Thompson, 5.

15 Thompson, 6.

16 Naomi Klein, "Climate Change."

17 Chung, "Birds Migrating."

18 Prystupa, "Boreal Ducks."

19 "Songbirds' Range Gets Squeezed."

20 Pawson, "That's Bananas!"

21 "Planting Zone Changing."

22 Wohlleben, *The Hidden Life of Trees*, 149–50.

23 ffrench-Constant et al., "Light Pollution."

24 "Distribution of Tree Species."

25 Kolbert, *The Sixth Extinction*, 162.

26 Chung, "Sea Life."

27 Chung.

28 Chung.
29 "King Crabs Invade."
30 "Ocean Absorption."
31 "Ocean Absorption."
32 Dell'Amore, "The Oceans Can't Protect Us."
33 Chung, "Melting Glaciers."
34 "Fear of Humans."
35 "Fear of Humans."
36 Chung, "Cities Are Driving Evolution."
37 On finches and mosquitoes, see Chung, "Cities Are Driving Evolution." The quote about swallows is from Weber, "Humans Are Having Huge Influence."
38 McKibben, *Eaarth*, 2, original emphasis.
39 McKibben, 27.
40 Zerubavel, *The Seven Day Circle*, 4.
41 Zerubavel, 97.
42 Birth, "Time and the Biological," 215.
43 Birth, 215.
44 Birth, 223.
45 Ekirch, "Dreams Deferred."
46 Crary, *24/7*, 10.
47 Crary, 3.
48 Saner, "Why You Should Start."
49 Anwar, "Poor Grades."
50 Saner, "Why You Should Start."
51 Loury, "Is Your Alarm Clock."
52 Kozicka, "Best Time to Work Out."
53 Kozicka.
54 Cuttler, "Timing Is Everything."
55 Sharma, *In the Meantime*, 20.
56 Sharma, 79.
57 Dionne Brand, *Inventory*, 93.
58 Mowat, *Never Cry Wolf*, 86, 89.
59 Mowat, 89.
60 Mowat, 90.
61 Rinehart, "Farley Mowat."

62 Gowdy, *The White Bone*, 24.

63 The factual details in this paragraph come from "It's Going to Be a Green Christmas" and "Why New York." The comments about Santa Claus stand to reason.

64 "Heat Record"; Gillis, "Earth Sets a Temperature Record."

65 "It's Going to Be a Green Christmas."

66 @paulnethery, "Happy Canada Day."

67 Zimbardo and Boyd, *The Time Paradox*, 100.

68 Hamilton, "Climate Change Is Wreaking Havoc."

69 Burke et al., "Higher Temperatures Increase Suicide Rates."

70 Hamilton, "Climate Change Is Wreaking Havoc."

71 Ostapchuk et al., "Exploring Elders' and Seniors' Perceptions," 18.

72 Nixon, *Slow Violence*, 4.

73 Cunsolo and Landman, "Introduction," Kindle location 384. Cunsolo and Landman's book is an excellent resource for thinking through and engaging with ecological mourning.

74 Cunsolo and Landman, 384.

75 Hamilton, "Climate Change Is Wreaking Havoc."

76 Thomas, "Climate Depression."

77 Taylor, "A Visit to the Climate Anxiety Doctor."

78 Ireland, "Hitting the Plastic Slopes."

79 Barde, "Vail Resorts Reimagines."

80 Adam, *Timescapes of Modernity*, 65.

81 Adam, 9.

82 Naomi Klein, "Naomi Klein Interview."

83 Suzuki, "Long Work Hours Don't Work."

84 Nadkarni, "Perpetual Guardian."

85 While the notion of a universal basic income has been much discussed in recent years, Anna Coote compellingly argues that such a policy would still hold people largely at the mercy of the cost of living under capitalism. She advocates instead for "universal basic services," which is to say a renewed commitment to ensuring that healthcare, education, housing, and other services are easily accessible to everyone (Coote, "Universal Basic Income").

86 Stronge, "Work Isn't Working."

87 Rosa, *Social Acceleration*, 156–59.

88 Heise, *Imagining Extinction*, Kindle location 180.

89 McKibben, "High Ice."

90 Sandilands, "Acts of Nature," 128.

91 Sandilands, 129.

92 Fiamengo, "'The Animals in *This* Country,'" 2. While Laurie Ricou notes that animal stories hold a position of historical significance within Canadian literature, he suggests that an emphasis on bioregions and ecosystems in literary and cultural studies would radically disrupt our understanding of the fields. "I hope to argue," he writes, "the value of shifting ecocriticism's dominating emphasis from place towards a system of animals and plants, water and soil. To do so will necessarily disturb the long-standing primacy of landscape-place in Canadian literary criticism" (Ricou, "Disturbance-Loving Species," 161). My attempt to see configurations of time as a dominating emphasis might be understood, in some ways, as a complementary project.

93 Atwood, "Bear Lament," 52–53, emphasis added.

94 Heise, *Imagining Extinction*, Kindle location 4925. Heise notes a particular case in which members of certain Inuit communities have argued that disruptions to the health and behaviour of the bears can be traced not so much to climate change but rather to physical interference by conservation biologists (4925). She cautiously notes that she is not able to resolve this disagreement.

CLOCK THREE: THE SKELETON WATCH

1 See, for instance, Frank Donoghue's book *The Last Professors: The Corporate University and the Fate of the Humanities*.

2 Adams, *Mostly Harmless*, 26.

3 See Lombardi, "Why Is a Minute Divided," on Egypt and Babylonia; Landes, *Revolution in Time*, 6, on mechanical clocks in medieval Europe; Sobel, *Longitude*, 106, on the marine chronometer that John Harrison developed in the eighteenth century for

imperial colonization; Allen, *A Republic in Time*, 1, on the industrial mass production of clocks; and Dyer, *The Story of Edward Howard*, on the use of wristwatches during the First World War. Dyer notes that women in the British aristocracy had owned wristwatches as far back as the sixteenth century; male soldiers started to wear watches in the late nineteenth century, but it was the First World War that led to the massive popularity of the wristwatch in the civilian world.

4 Birth, *Objects of Time*, 2.

5 Allen, *A Republic in Time*, 86.

6 Allen, 86.

7 McKay, *Vis à Vis*, 60.

8 Kiyooka, "Kyoto Airs," 10.

9 Donaldson, *Missing Link*, 38.

10 McKay, *Vis à Vis*, 62.

11 Crary, *24/7*, 10.

12 Rosa, *Social Acceleration*, 21, original emphasis.

13 Rosa, 322.

14 Shakespeare, *King Richard III*, 5.2.23.

15 McKay, *Vis à Vis*, 19.

16 Bastian, "Fatally Confused," 31, original emphasis.

17 For one of the many articles on the circulation of microplastics within ecosystems and human bodies, see Douglas Quenqua, "Microplastics."

18 Honoré, *In Praise of Slow*; Berg and Seeber, *The Slow Professor*.

19 Sharma, *In the Meantime*, 111. Many works belonging to the Slow Movement have a difficult time coming to terms with this limitation. Maggie Berg and Barbara Seeber's *The Slow Professor*, for instance, is inspirational in its call for university faculty members to embrace slowness as a form of resistance against the neoliberalization of education; however, it does not quite address the facts that the option of slowness is available primarily to fully tenured professors who occupy positions of privilege (usually older men); that intentional slowness is unrealistic for the precarious contract workers who perform most of the teaching work; and that those privileged faculty members

who do embrace slowness will risk imposing greater workloads (and more acceleration of labour) onto their precarious and less prestigious colleagues. One of the reasons that pleas to slow down—or, in the case of my discussion here, pleas to cease development of pipeline projects—create social tension is that the slow, cautionary approach has higher costs for some populations than others.

20 Rosa, *Social Acceleration*, 157–59.

21 Nixon, *Slow Violence*, 2.

22 Nixon, 3.

23 Nixon, 22.

24 Taber, "PM Brands Canada."

25 Paris, "Speeding Up."

26 Paris, "Budget Shortens."

27 "Northern Gateway Review."

28 Paris, "Greenhouse Gas."

29 Steffen, "Predatory Delay."

30 McCarthy, "Oil Industry Successfully Lobbied."

31 Canada's federal government approved the Northern Gateway pipeline project, with conditions, in 2014, a decision met with protest from many groups. However, in June 2016 the Federal Court of Appeal overturned this approval due to the government's failure to perform proper consultations with First Nations (Proctor, "Northern Gateway"). Justin Trudeau's Liberal government, which had taken power from Stephen Harper's Conservative party by this time, decided not to appeal the ruling (Tasker, "Ottawa Won't Appeal"). And yet, just weeks after this decision, the Liberal government went on to approve the Kinder Morgan Trans Mountain pipeline and the Enbridge Line 3 pipeline (Tasker, "Trudeau Cabinet Approves"). As for the short time limits for environmental assessments, an advisory panel to the federal Environment Minister concluded in April 2017 that the time limits were not working well (McDiarmid, "Short Timelines"). This was followed in 2018 by the announcement that a new review agency would be created with even tighter deadlines: 300 days for smaller projects and

600 days (about 20 months) for larger ones (Tasker, "Ottawa to Scrap"). There is always another project, another controversy, another rush, another delay. What remains constant is the need to develop critical readings of temporal power.

32 "Alberta Sets New Rules."

33 "Alberta Sets New Rules."

34 Porter and Stockdale, "The Strategic Manipulation," 271.

35 Porter and Stockdale, 275.

36 Porter and Stockdale, 280–81.

37 Bronskill, "CSIS Says."

38 On the urgent meanings of combustion in the era of climate crisis, see also Catriona Sandilands's article "Combustion."

39 Lam, "Vancouver Poet Rita Wong Incarcerated."

40 In her study of public hearings on the proposed Northern Gateway pipeline, Patricia H. Audette-Longo shows how prayers offered by Indigenous community members challenged the dominant national vision of the future. These prayers, many of which were documented in the official record of the hearings, call attention to "the problem of competing concepts of time and intergenerational relationships" (Audette-Longo, "Prayers on the Record," 68).

41 Thomas King, *The Back of the Turtle*, 288.

42 King, 275.

43 King, 289.

44 King, 113–14.

45 King, 437.

46 King, 320.

47 King, 320, 322–24.

48 King, 396.

49 King, 176–77.

50 King, 191.

51 King, 191–92.

52 King, 193.

53 King, 504.

54 See King, 39–40, for Dorian's experience with his new mattress. The other elements of the novel mentioned here have already been cited above.

55 King, 504.
56 King, 505.
57 King, 516–17.
58 King, 516.
59 McKay, "Quartz Crystal," 15.
60 McKay, 15.
61 McKay, 15-16.
62 I am grateful to Nicholas McCormick for pointing out to me how several of the items in McKay's list can be said to keep time in particular (and therefore limited) ways.
63 Allen, *A Republic in Time*, 184.
64 McKay, "Quartz Crystal," 16.
65 Homer, *The Odyssey*, bk. IX.
66 McKay seems to allude here to the lines in E.J. Pratt's long poem *Towards the Last Spike* where the mountain ranges "Had wakened up one geologic morning / To find their scalps raked off, their lips punched in" (Pratt, *Towards the Last Spike*, lines 1045–46). The geological and ecological forces of rock, water, and trees have battled one another across deep time, a conflict into the midst of which the railroad workers suddenly appear with their own intentions of reshaping the earth in quick order.
67 Mason, "Literature and Geology," 483.

CLOCK FOUR: THE RECREATIONAL VEHICLE

1 For a detailed discussion of the forms of discourse and representation tied up in oil production, see Jon Gordon, *Unsustainable Oil*.
2 "Go RVing Unscheduled English."
3 Landes, *Revolution in Time*, 7.
4 Levine, *A Geography of Time*, 82.
5 Levine, 155, 158.
6 Newfoundland and Labrador Tourism, "Half Hour." My brief comments here about the Newfoundland and Labrador ads are adapted from a larger point I made about them in *Timing Canada* (53–54).

7 Newfoundland and Labrador Tourism.
8 "Schedule Some Unscheduled Time."
9 Cronon, "The Trouble with Wilderness."
10 Sharma, *In the Meantime*, 111.
11 Sharma, 111.
12 Trono, "A Better Distribution Deal," 60.
13 Atwood, "True Trash," 13.
14 Atwood, 13.
15 Johnson, *The Moccasin Maker*, 149.
16 Hay, *Late Nights on Air*, 246.
17 Hay, 279.
18 Wharton, *Icefields*, 195, original emphasis.
19 Wharton, 251.
20 Wharton, 273.
21 Hay, *Late Nights on Air*, 225.
22 Banting, "Geography as Intertext," 301.
23 Fabian, *Time and the Other*, 31.
24 Works of historical fiction, a prominent form in Canadian literature, also frequently serve to question assumptions about the progression of time. In his study of Canadian historical novels, Herb Wyile notes that "speculative fiction is not an objective, detached, authentic glimpse into the future, but rather usually a very purposeful, subjective, and rhetorical extrapolation from present circumstances, and the same might be said of historical fiction. Except, of course, that it faces in the opposite direction" (Wyile, *Speculative Fictions*, xii).
25 See Lunau and Engelhart, "Why the Higgs Boson Discovery Changed Everything," for a compelling account of these events.
26 Sawyer, *Flashforward*, 193.
27 Sawyer, 249–50.
28 Sawyer, 299.
29 Evernden, *The Natural Alien*, 85.
30 Sawyer, *Flashforward*, 299–300.
31 Davies, "That Mysterious Flow," 13.
32 Peter Wohlleben argues that because trees can distinguish between the true onset of spring and the misleading appearance

of what is merely a warm span of days, they must have "a sense of time" as well as "memory" (Wohlleben, *The Hidden Life of Trees*, 147–49). The philosopher Tam Hunt goes so far as to argue that "all things may be viewed as at least a little conscious" and that the differing degrees of consciousness within an electron, a pile of sand, and a human being depend largely on the speed of information exchange within different structures (Hunt, "Could Consciousness").

33 Abram, *The Spell of the Sensuous*.

34 Bastian, "Inventing Nature," 102–03.

35 Lunau and Engelhart, "Why the Higgs Boson Discovery Changed Everything."

36 Mandel, *Station Eleven*, 17–18.

37 Mandel, 20.

38 Mandel, 22.

39 Mandel, 23–24.

40 Mandel, 234.

41 Rosa, *Social Acceleration*, 151.

42 Mandel, *Station Eleven*, 31.

43 Mandel, 25.

44 Mandel, 36.

45 Some scholars have criticized *Station Eleven* because it does not adequately critique capitalism. Diletta De Cristofaro argues that the novel sees the pre-collapse world almost entirely through a lens of nostalgia, and that it is "too complicit with the current system and its exploitations" (De Cristofaro, "Critical Temporalities," 17). Maximilian Feldner similarly finds the novel is characterized by nostalgia for capitalism and modernity (Feldner, "Survival Is Insufficient," 172). These criticisms bother me because they make a good point. And yet, to do the novel justice, we need to recognize that much of its power comes from the way it takes nostalgia seriously as a process that is both inevitable and ironic. By developing a perspective from which we can see the familiar world as though from the outside, the narrative develops an ironic perspective on modern civilization. Certainly it characterizes capitalism and modernity as fragile

and self-defeating. Of key interest here is the fact that the irony and the nostalgia trouble one another in productive ways. For instance, the narrative explores Clark's sadness as he realizes that, in his corporate job, he has been living without a larger sense of joy and purpose, yet the loss of this imperfect way of life as a result of the collapse creates its own form of sadness and mourning.

46 Mandel, 35. The novel does not seem to specify whether the "white-hot sky" is a result of climate change, but I would suggest that an explicit statement to this effect is not really necessary. To the extent that it is realistic, any work of speculative (or contemporary) fiction must incorporate climate change as a reality.

47 Mandel, 83.

48 Mandel, 278.

49 Mandel, 231.

50 Mandel, 232.

51 Mandel, 232.

52 Mandel, 313.

53 Zhou and Coleman, "Accelerated Contagion," 127–28.

54 Rosa, *Social Acceleration*, 322.

55 Rice, *Moon of the Crusted Snow*, Kindle location 43.

56 Rice, 86–87.

57 Rice, 170–71.

58 Rice, 1350.

59 Daschuk, *Clearing the Plains*, xii.

60 Daschuk, 12.

61 Whyte, "Our Ancestors' Dystopia Now," 207.

62 Rice, *Moon of the Crusted Snow*, Kindle location 1669.

63 Rice, 1670–78.

64 Rice, 405–06.

65 Rice, 2268.

66 Rice, 1714.

67 Rice, 1703–06.

68 Rice, 2191.

69 Rice, 2371–72.

CLOCK FIVE: THE ARCTIC ALLIGATOR SWAMP

1 Goodyear, "Giant, Flightless Birds."
2 Goodyear.
3 Kolbert, *The Sixth Extinction*, 123–24. On the matter of how fossil fuels can be said to recreate the conditions of the ancient Earth, also see Mark McCutcheon's reading of Christopher Dewdney's poem "Sol du Soleil" (McCutcheon, *The Medium Is the Monster*, 178).
4 Ghosh, "Rebound."
5 Ricoeur, *Time and Narrative* vol. 1, 3.
6 See, for instance, Yanqiu Rachel Zhou and Kelly Coxson's discussion of social workers who are encouraged to exercise resilience in response to the exhausting demands of their profession. When not accompanied by any legitimate support structures, such a vision of resilience is "consistent with the neoliberal trend of downloading responsibility onto individuals" (Zhou and Coxson, "'Resilient' Social Workers," 64).
7 Williams et al., "Organizational Response to Adversity," 48.
8 Bök, *The Xenotext*, 150.
9 Bök, 150–51.
10 Vanderborg, "Transgenic Poetry."
11 Ryan, "Biological Processes as Writerly?," 135.
12 Bök, "The Dire Seed," 393.
13 Volmers, "Weird Science."
14 Timblin, "The Making of a Xenotext."
15 Timblin.
16 Anthony Davis, "The Xenotext."
17 Callanan, "The Xenotext's Woman Problem."
18 Adams, *The Salmon of Doubt*, 130.
19 Vanderborg, "Transgenic Poetry."
20 Ryan, "Biological Processes as Writerly?," 142.
21 Fox-Skelly, "There Are Diseases Hidden in Ice."
22 Fox-Skelly.
23 Revich and Podolnaya, "Thawing of Permafrost."
24 Revich and Podolnaya.
25 Revich and Podolnaya.

26 Zerehi, "Climate Change Could Expose."
27 Zerehi.
28 Carrington, "The Anthropocene Epoch."
29 Laville and Taylor, "A Million Bottles a Minute." The oft-cited figure about plastic outweighing fish involves a certain amount of guesswork about both plastic and fish, but the notion is reasonably plausible and is horrible even if the numbers need more precision (see Gatehouse, "Will There Be More Plastic Than Fish").
30 Bastian and van Dooren, "Editorial Preface: The New Immortals," 1.
31 Bastian and van Dooren, 5.
32 Farrier, "How the Concept of Deep Time Is Changing."
33 Bök, *The Xenotext*, 151.
34 Yin-shun, *The Way to Buddhahood*, 68–69.
35 Atwood, *Negotiating with the Dead*.
36 Wolfreys, *Victorian Hauntings*, 3.
37 Colin Davis, "Hauntology, Spectres and Phantoms."
38 Wolfreys, *Victorian Hauntings*, 3.
39 Donaldson, *Missing Link*, 45.
40 Wong notes that in order to source the words in the poem that belong to Halq'eméylem and other Indigenous languages, she used the FirstVoices language resource at firstvoices.com. I have used the same website to identify English translations for the words.
41 Wong, "Q'élstexw," 59.
42 Dionne Brand, *Thirsty*, 24.
43 Roberts, "Writing Settlement," 79.
44 To give one example of this debate, Peter Brannen argues with reference to the palaeontologist Doug Erwin that we are not currently in a sixth extinction (Brannen, "Earth Is Not in the Midst"), while a quantitative analysis in the journal *ScienceAdvances* argues that "a sixth mass extinction is already under way" (Ceballos et. al., "Accelerated Modern Human-Induced Species Losses"). Brannen has also argued that the notion of the Anthropocene as a geological epoch involves a great deal of arrogance, given that the passage of millions of years may

all but erase any geological record of human activity (Brannen, "The Anthropocene Is a Joke"). This prediction may largely hinge on whether a sixth extinction is under way.

45 Brannen, *The Ends of the World*, 6.

46 Brannen, 5.

47 Brannen, 108.

48 Brannen, 7, original emphasis.

49 Brandt, "Optimistic Thots," 52.

50 Farrier, "How the Concept of Deep Time Is Changing."

51 Diamond, *Collapse*, 522.

52 Sandilands, "Acts of Nature," 128.

53 Heise, *Imagining Extinction*, Kindle location 174–75.

54 O'Brien and Lousley, "A History of Environmental Futurity," 1.

55 Stephen King, "Why We Crave Horror Movies," 88.

56 As a number of participants at the Social Life of Time conference in Edinburgh in 2018 pointed out to me, the looming threat of the Arctic alligators is reminiscent of the crocodile in *Peter Pan* that endlessly shadows Captain Hook, craving the taste of blood. Having swallowed a clock, the crocodile makes a ticking sound that allows Hook to escape when it draws near. Smee, though, correctly observes that "some day . . . the clock will run down, and then he'll get you" (Barrie, *Peter Pan*, chapter 5).

CONCLUSION: THE CLOCK'S WOUND UP

1 Yong, "How Coral Researchers Are Coping."

2 Cunsolo and Landman, "Introduction," Kindle location 497.

3 McKay provides an explanatory note about the Shay engine in *Strike/Slip*, 75.

4 McKay, "Waiting for Shay," 20.

5 McKay, 21.

6 Coleman, *In Bed with the Word*, 38.

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"Optimistic Thots" from *Walking to Mojácar* by Di Brandt (Winnipeg: Turnstone Press, 2010).

Fallen Time. D.P. Brown. Egg tempera on masonite, 23½ × 16 inches, 1963. Collection of the Owens Art Gallery, Mount Allison University, Sackville, NB. Reprinted by permission of the artist.

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Page numbers for figures are listed in italics.

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ABOUT THE TYPE

THIS BOOK IS SET IN VILLAGE. David Berlow undertook the revival of Frederic W. Goudy's Village family in the early 1990s as the first real step in the successful redesign of *Esquire* magazine. Goudy originally cut Village No. 2 in 1932 to bring early ideas up to date, adding the italic a year or two later for his own satisfaction. Font Bureau expanded Village, the model for Goudy's mature style, into a ten-part series designed for Esquire's use in text and display.

THE ACCENT TYPE IS SET IN BUREAU GROTESQUE. Designed by David Berlow and initially released in 1989 as Bureau Grotesque, the typeface has come to be acknowledged as the quintessential interpretation of the English 19th century sans serif. Inspired by the grotesques of Stephenson Blake, Berlow harmonized the greatly differing character shapes of his model and expanded the design into a family of several matching weights and widths. At the same time he kept the typical lively character and idiosyncrasies of the early sans serifs intact, which lend the series much of its flavor.

PHOTO: BLUMPICS

ABOUT THE AUTHOR

Paul Huebener is the author of *Timing Canada: The Shifting Politics of Time in Canadian Literary Culture*, which was a finalist for the Gabrielle Roy Prize. He is an associate professor of English at Athabasca University.