JOURNAL OF NORTHERN STUDIES Vol. 9 • No. 1 • 2015, pp. 33–50

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Media Environments

Icebergs/Screens/History

ABSTRACT Icebergs, at present, are living a second life on screens. While they are one of the natural world's most photogenic objects, icebergs are also subject to modes of representation through parametric modeling applications. The purpose of this digital life on screens is largely confined to determining how, and under what conditions, icebergs can be made a source of potable water for the planet. Yet icebergs have a story to tell about the epistemological and economic production of northern natural resources. Distinct institutional actors, from oceanographers and military engineers to Saudi royalty and software design companies, have sought to control and come to know icebergs through specific practices of modeling. I argue that the representation of icebergs is a contingent practice that has often been bound up with processes of commodification. To come to know icebergs we have to come to know how these quintessentially polar phenomena have been represented and commodified, across the twentieth century and at a significant remove from the highest latitudes of the planet. The increasing pace of northern development, with natural resources at the vanguard of corporate and governmental incursions, signals the emergence of "media environments" that are extending the representation of (and control over) natural phenomena through a series of media technologies, from 3D modeling applications and collections of satellite data to virtual reality environments and predictive algorithms.

KEYWORDS icebergs, natural resources, water, modeling, media environments

Introduction

The white berg lies still on the grey-blue water. Its tabular mass is hard to determine, though we are flying in over its craggy peak. Up close, the ice is a light blue, transparent, a fragile surface holding itself together. With a quick turn of the wrist, the iceberg spins on its axis, freely rotating like a top. Welcome to the world of 3D modeling.

Icebergs, at present, are living a second life on screens. While they are, without a doubt, one of the natural world's most photogenic objects, icebergs are also subject to representation through parametric modeling applications. The purpose of this digital life on screens is largely confined to determining how, and under what conditions, icebergs can be made a source of potable water for the planet. While this is a practice with a rather long history, going back millennia to indigenous forms of water provision, for metropolitan, Western social formations it dates back to the middle of the nineteenth century and the early industrial conversion of icebergs into water destined for human purposes (Cruikshank 2005; Gosnell 2005; Pyne 1986). Icebergs, and the potential they hold as a source of water for the dry and drought-ridden regions of the world, constitute a little-known touchstone in historical and contemporary debates on the ethical and ecological limits of the extractive industries. For well over a century, actors have sought to move icebergs from their points of origin, calving off of glaciers and ice sheets in both the Arctic and Antarctic, to lucrative markets in Chile, California, and Saudi Arabia, amongst other countries.

In this article, I want to make the case that environmental historians, and northernists in particular, can benefit from thinking further about how icebergs have a story to tell about the epistemological and economic production of northern natural resources. I show how distinct institutional actors, from oceanographers and military engineers to Saudi royalty and software design companies, have sought to control and come to know icebergs through diverse practices of modeling. The representation of icebergs is a contingent practice that has often been bound up with processes of commodification. To come to know icebergs we have to come to know how these quintessentially polar phenomena have been represented and commodified, across the twentieth century and at a significant remove from the highest latitudes of the planet. Once seen as emergent natural resources subject to diverse modes of southern corporate and governmental control, their very status as site-specific polar objects is challenged.

Most scholars would agree that we should not take the politics and power dynamics of our objects of study for granted. Yet little attention has been paid to the ways in which distinct representational tools have historically constructed Northern environments (and their phenomena) for

the purposes of extraction. It is through these very interfaces that certain iterations of icebergs get "made." Environmental historians are particularly well placed to read through the layers of signification contained in such representations. In my reading, northern environments, and icebergs in particular, extend across their instantiations in various media, from paper diagrams to integrated digital drift models. By extending our considerations of what constitutes the environment (Biggs 2014), we as historians can begin to intervene in these concrete forms of mediated decision-making being undertaken by institutional, corporate, and government actors intent upon regulating and interacting with the natural world. The increasing pace of northern development, with natural resources at the vanguard of corporate and governmental incursions, signals the emergence of what could be thought of as "media environments" that are extending the representation of (and control over) natural phenomena through a series of technologies, from 3D modeling applications and collections of satellite data to virtual reality environments and predictive algorithms.

The work of Paul Edwards clarifies how competing representational claims being made about "the environment" are bound up with the concrete worlds of computer simulation and satellite data sets, amongst a host of other media technologies that shape the parameters of the sensible, and, by extension, the factually given (Winsberg 1999; Edwards 2010). Icebergs and the media environments of which they are a part constitute important if emergent elements for the scholarly practices of environmental historians. They are of particular relevance for Northern environmental history because, to borrow a phrase from Julie Cruikshank (2001: 377–378), the Arctic and Antarctic are zones of amplification—spaces where anthropogenic environmental change is particularly apparent. As a result, they can seem to be perpetually undergoing processes of forecasting, prediction, and calculation, all of which project these supposedly remote environments into media(ted) and digital environments of the future.

Media environments are co-produced with institutional and corporate decision-making, the impacts of emerging and contentious resource industries, and anthropogenic environmental change.[1] In contexts wherein data sets, modeling, and "parametrization" often narrow the group of actors involved in making decisions that affect environmental outcomes (Edwards 2001: 64), models and model-making processes are mobile forms of semiosis. As some of the episodes I recount below show, such models deploy visualization and projection in order to mobilize public opinion, further geopolitical interests, or raise funds for schemes on the borderlands of ethical and ecological responsibility.

It would seem that media environments take their diverse points of de-

parture through interfaces that look to the future, such as forecasted melt rates and predicted transportation routes. Yet the choice of what parameters and characteristics to employ within a media environment is far from self-evident. Analyzing why icebergs have been represented on screens in the way they have reveals much about the actors who construct these very representations. Much as Edwards provides "the climate" with its data-driven past (Edwards 2010), so too can icebergs reveal something about past modes of calculation, epistemologies of extraction, and practices of visualization. "Modern 4D assimilation systems," as Edwards writes, "literally synthesize global data, constrained but not determined by observations" (Edwards 2010: 433). The drive to generate truly accurate *global* data, derived and adopted from the established practices of meteorologists and their associated institutional settings (Harper 2008: 226), can, in part, be read through current corporate efforts to forecast the potential tow-paths of North Atlantic icebergs. The creation of icebergs as objects of potential commercial exploitation is linked to their representation as objects with controllable, predictable characteristics. This operation, running from the 1940s to the present day, is also part of a broader post-war turn towards quantification and quantifiable models in the natural and physical as well as the human sciences (Edwards 1996; Porter 1996; Edwards 2010). Northern environments, and polar phenomena such as icebergs, have also increasingly fallen within the ambit of a scaled-up view of high modernism and its focus on technological megaprojects, which have both enabled and eventually led to the commodification of natural resources on ever-larger scales in the second half of the twentieth century (Scott 1998). To return to Cruikshank, icebergs can indeed be objects of amplification for Northernists: that is, both very concrete and measurable markers (or predictive models) of anthropogenic environmental change, and equally mobile, metaphorical, and generative emblems of the meeting point between a warming atmosphere and ice.

In a first section, "Cold Regions, Research, Laboratory," I examine some of the earliest schemes to transport icebergs from the Arctic and Antarctic to the dry regions of the world, with proposals originating from at such diverse institutional sites as the Scripps Institution of Oceanography and the RAND Corporation. In the next section, "3D," I consider the more recent case of French engineer Georges Mougin, who undertook a series of modeling experiments beginning in the 1970s to test the economic and physical feasibility of towing an iceberg from Antarctica to Saudi Arabia. Mougin's plan has been taken up recently by Dassault Systèmes, a major player in the world of corporate digital simulations, who have rechristened it "icedream" (Dassault Systèmes n.d.*a*) in order to concretize its feasibility through to the deployment of an array of environmental modeling technologies. While

each section offers its own media-derived story of how icebergs have been documented, managed, and deployed as objects of human concern, they seek to collectively produce insight into the ways in which icebergs have become emblematic phenomena through which engineers and scientists are forecasting a future with fewer and more costly sources of potable water.

Cold Regions, Research, Laboratory

In the 1940s, climate change was generally a distant concept to be lived by other times, places, and peoples. For John D. Isaacs, a newly hired polymath and sometime oceanographer at the Scripps Institution of Oceanography in La Jolla, California, melting ice could be viewed simply as a temperature problem to be solved rather than a weightier marker of widespread ecological change. Within today's oceanographic community, Isaacs is considered an intriguing outlier. He was largely self-taught as an oceanographer, with his only formal degree being a bachelor of science obtained in 1931. Yet by the time of his death in 1980, he was a member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences (Bascom 1983). Prior to studying ocean phenomena, he had experienced them as a sailor and fisherman off the coast of Oregon. It was during his first seminar at Scripps, in 1949, that he put forward the seemingly outlandish idea of towing an Antarctic iceberg to southern California in order to address the state's persistent water shortages, notably for irrigation purposes (Behrman & Isaacs 1992: 3–4).

At Scripps, Isaacs undertook his early speculative work on the transportation of ice under the directorship of Harald Ulrik Sverdrup, one of the founders of modern physical oceanography. Sverdrup, Martin Johnson, and Richard Fleming's *The Oceans. Their Physics, Chemistry, and General Biology*, published in 1942, was an early attempt at a taxonomy and synthesis of the world's oceans. It was an ambitious book, and it marked Sverdrup's aim of importing a rigorous physical oceanography to Scripps, as well as a wide–ranging research agenda that was to focus its attention on the California Current and to undertake the first comprehensive hydrographic survey of the Gulf of California (Nierenberg 1996: 349). The relational possibilities of scale could allow Isaacs and others to draw points of connection between seemingly disparate geographic locations, meteorological events, and ocean phenomena. Moreover, the involvement of Sverdrup and Isaacs, amongst other oceanographers and meteorologists, in the American war effort provided them with the ability to produce "tactical intelligence" that, after the war's end, would continue to resonate as a goal of the American government when it came to managing its hydrographic resources (Seiwell 1947: 202).

Today Isaacs's scheme might seem an outlandish piece of geo-engineering,

yet at the time it was perceived as a practical, economical solution to the problem of water shortage. With costly and soon to be controversial desalination and aqueduct projects underway in California (Reisner 1986), the latter already affecting the Colorado River, Isaacs's idea fit in with his broader view of the ocean as an instructive ecology. He argued that "the totality of the interaction of the continents, the sediments, the winds, the weather, the water, organisms, chemistry, atmosphere, all of it," was important and needed to be taken into account when making incursions into the environment (Behrman & Isaacs 1992: 19). Isaacs believed in the episodic and large-scale event that had the power to change the course of the natural world, deeming many of his contemporaries' ideas about nature "unnatural" in their lack of interdependence with meteorological, climatological, and anthropogenic causation. He approached nature as a "highly variable system" that above all else needed to be understood in its stochastic mode, without the benefit of human security (Behrman & Isaacs 1992: 41). As such, it was perhaps fitting that it was Isaacs who would revive and rescale the idea of using Antarctic icebergs as a source of fresh water. His biographer, Daniel Behrman, deems this Isaacs's best-known scheme, and throughout the 1950s and 1960s it would circulate around the world.

Isaacs's iceberg scheme benefited from the prevailing faith that American governing institutions held in the technical capacities of resource provision, notably when it came to water. With "the West," and the Colorado River in particular, holding emblematic positions in this technocratic imaginary (Hundley 2009), Isaacs came upon the idea while thinking through the problem of how to go about moving large quantities of water from one location to another. More specifically, he was concerned with evaluating the potential cost of an underwater pipeline connecting the Columbia River to southern California. He soon realized that once the container was optimized, taking into account such factors as distance and the increased cost of width of the pipe, he had obtained an object with dimensions approaching that of a tabular Antarctic iceberg (Behrman & Isaacs 1992: 50). Over the next decade, the idea would occasionally get picked up and dropped by science reporters and the press at large. In a 1956 interview with the *Los Angeles Examiner*, Isaacs worked through the variables involved in towing an Antarctic iceberg to San Clemente Island near San Diego, factoring in the power requirements needed to move the berg along (the equivalent of one, or, possibly, two atomic bombs, in his estimation, using the energy currency of his time) (Behrman & Isaacs 1992: 51).

At Scripps Isaacs experimented with various wrapping materials, largely plastics, to slow the melting of a berg. He worked with six-hundred-pound ice blocks, and observed how the berg would change shape over the course

of the towing, assuming the outline of a ship's hull. As such, he recommended that the berg not be wrapped from the outset so that it could take on this more hydrodynamic shape. As with many of Isaacs's thought experiment-like ideas—so attractive in their profound impact and simplicity that they attracted the interest of the *Saturday Evening Post*, *Reader's Digest*, the *Encyclopedia Britannica Yearbook*, and *Life*'s book publication series—he had merely prepared the ground for others to investigate it in further detail. This idea was also circulating across a state and, to some extent, a country grappling with recurring meteorological crises and a waning belief in the self-regulation of the earth's own ecological capabilities, with California a dry marker of a nascent "hydraulic society" that was constantly seeking after ready-made solutions to its chronic water shortages (Hundley 2001). Isaacs's packaging of the scheme as popular, amenably readable, cost-effective, and, above all else, feasible, laid the discursive groundwork for his seemingly outlandish idea to travel from the popular press to governmental and institutional interests. By describing the plan in such detail and by publicizing his role as author, Isaacs kept it alive and in the public eye. Yet Isaacs's framing of the project was also in line with the prevailing aim of expanding the "functional approach" to natural resource theory, pioneered by Erich Zimmerman's *World Resources and Industries* (1933). Isaacs was to some extent discursively drawing out Antarctic icebergs, shaping their popular and public representation so as to suggest that they were latent (yet available) resources for human consumption. He was making a persuasive case for the American public to believe in.

By the late 1960s, the idea held the interest of Wilford F. Weeks of the U.S. Army Cold Regions Research Laboratory at Hanover, New Hampshire, and William J. Campbell of the U.S. Geological Survey. They approached the problem of increasing water scarcity with the rationale that since 85 per cent of the world's fresh water was held in the form of ice in the Antarctic and Greenland, it could follow that this ice should act as a reserve to be tapped if the appropriate technical and economic conditions could be met (Weeks & Campbell 1973*b*). An object from a polar environment could thus become a quantifiable (and controllable) commodity for global economic consumption. Weeks and Campbell's article in the *Journal of Glaciology* (1973), republished in less technical detail in the *Bulletin of the Atomic Scientists* in May of that year, set out to demonstrate that the towing of icebergs to select locations in the Southern Hemisphere was both feasible and desirable (with the latter article coming below a photograph of three icebreakers pushing a tabular Antarctic iceberg near McMurdo Station). It was a form of demonstration that relied on extending Isaacs's more speculative framework into the domain of hard facts and calculability. Weeks and Campbell

identified the Amery and Ross Ice Shelves in the Antarctic as the prime sites for the production of icebergs, with their situation possibly leading to less resistant tows given the prevailing ocean currents. They deemed the most favourable and likely destinations to be the Atacama desert in Chile and the arid regions surrounding Perth in southwestern Australia.

Like Isaacs, Weeks and Campbell augmented experimentation on (small) physical icebergs with calculations of how icebergs could be expected to behave when towed long distances. To make their calculations, Weeks and Campbell drew on data provided by the Earth Resources Technology Satellite, also known as Landsat 1, the United States's first satellite dedicated to monitoring the earth's natural resources (Mack 1990; Parks & Schwoch (eds.) 2012). In addition, they performed a series of towing tests to determine the variable levels of drag occurring at different velocities, here concretely building on Isaacs's experiments with the ice blocks and their assuming the shape of a ship's hull. Pursuing their more precise calculations, they proposed building a "super-tug" that would be able to tow a berg with a width of 2.8 kilometres at a rate of 0.5 metres per second (Weeks & Campbell 1973*b*: 36); defined the melt losses in relation to wind and water temperature; and, finally, noted that determining the precise economic benefits to be derived from this method of water delivery were difficult to pinpoint given the number of factors that were dependent on the site-specificity of the delivery location. In their estimation, the ultimate price of iceberg water should be based on the going rate for irrigation water, as this was its most likely end usage.

Weeks and Campbell identified two major gaps in their study. The first was the absence of a data-derived assessment of the costs and losses associated with processing the ice upon delivery. The second concerned the uncertainty surrounding the climatological and oceanographic effects that could be expected as a result of having an iceberg of such a size inserted into a foreign ecology. Despite these unknowns, they considered their first approximation of the scheme a success in its ability to recoup what in their opinion was simply a matter of nature's waste:

> The best part of the scheme is that its principal commodity, the iceberg, is currently being completely wasted as regards man's needs. The icebergs calve from the shelves and drift in the Southern Ocean until they melt. The towing proposal merely redirects this water through an irrigation system on its way to the sea. We would guess that the potential rewards to man of the more tortuous path will prove to be well worth the additional energy expenditure. (Weeks & Campbell 1973*b*: 39.)

The manner in which Weeks and Campbell couched their more extensively

worked out version of Isaacs's scheme, as an extended irrigation system that would simply link back to the Antarctic and correct a deficiency in Nature's design, to some extent echoes Isaacs's own understanding of the importance of coming to understand the systemic interactions of complex ecologies. By bringing this "wasted" water into the purview of human interests, they were merely correcting—in their understanding, "redirecting"—what could be thought of as a "short-circuit" in the global environmental system. Weeks and Campbell were also making their case in the context of the consolidation of the West's real and perceived energy crises of the 1970s. Under these conditions of resource dependency, it is telling that they would promote a means of "piping," via this networked irrigation system, a new source of fresh water that would presumably be under the control of their national government. That the scheme also made economic sense, coming at a cost either less than or comparable to desalination programs, only strengthened their position: one had to convince cost-benefit conscious and risk-averse actors such as the federal government.

Later that same year, John L. Hult and Neill Ostrander, both physicists working for the RAND Corporation in Santa Monica, published a parallel report that addressed the seemingly increasingly real possibility of approaching Antarctic icebergs as a water resource at a scale available for the world as a whole (Hult & Ostrander 1973). This perspective saw Antarctic icebergs as an unlikely if technically possible solution to water scarcity. It was congruent with the RAND Corporation's espousal of a form of "rational choice" decision making, especially within environmental contexts juxtaposed with militarized economic rationales, that would inform policy makers in the early decades of the Cold War (Amadae 2003). While RAND was a broad institutional actor in constant evolution during these years, it was decisively influenced by the tenets of a social science seeking to encourage and sustain a certain version of American capitalism and democracy, both at home and abroad (Amadae 2003: 15). Modeling social and consumer behaviour patterns were abiding concerns. Such RAND-derived tracts as *The Calculus of Consent. Logical Foundations of Constitutional Democracy* (1962), written by James Buchanan and Gordon Tullock, would demonstrate how with increased information sources could come increased decision-making power, and, in turn, actionable, almost inevitable, outcomes.

Hult and Ostrander's comprehensive report is divided into three major sections detailing the current potential supply of (and demand for) fresh water, the technological feasibility of harvesting, transporting, and processing Antarctic ice, and an assessment of the potential social and environmental impacts of the practice. As they stated in the preface to the report, these physicists intended it to "provide background knowledge for potential users

and suppliers of Antarctic icebergs and for governments and agencies concerned with the development, regulation, or control of these valuable ice resources" (Hult & Ostrander 1973: iii). More so than Weeks and Campbell's analysis, the RAND report emphasized the economic potential of the bergs (estimating that a 10 per cent use of the annual yield of icebergs would be as much as $10 billion annually), and also the potential impediments presented by the surrounding sea ice. Hult and Ostrander claimed that satellite-derived imagery would aid in determining the precise characteristics of iceberg-sea ice behaviour over the coming years. In order to prove the feasibility of their proposal, they confined themselves to describing a model of the transport operations involved in moving tabular icebergs from the Ross Sea to southern California. They proposed to assemble a series of iceberg "trains," roughly three hundred to six hundred feet wide, over one kilometre in length individually but exceeding twenty kilometres when assembled into larger convoys. The individual tabular bergs would be linked by both propeller systems and icebreakers, with the entirety of the train propelled by a floating nuclear power plant (Hult & Ostrander 1973: vi). While they noted the widespread potential of emerging arid regions as buyers of iceberg-derived irrigation water, their report leaned towards the United States' Pacific southwest as one of the principal buyers and beneficiaries.

Across the three iterations of the scheme there is a discernible move towards increasing the accuracy of data-derived models, from Isaacs's experimental blocks of ice to Hult and Ostrander's ever more refined algorithms, which even accounted for phenomena such as the Coriolis force. In this shift, feasibility came to be commensurate with the increased availability, number, and reliability of environmental parameters—the broad accounting that Weeks, Campbell, Hult, and Ostrander all tried to incorporate into and reflect in their calculations. Each iteration, in its own way, was a translation of a series of environments that simply called for more data and an open-ended future that could be addressed through technical progress. This was clearest in the RAND report, with Hult and Ostrander using an unspecified "computer" to tabulate many of their findings (Hult & Ostrander 1973: 41–44). These same authors also called for the continued development of satellite observation as a crucial component of their ability to document the physical environments along the iceberg transportation routes (Hult & Ostrander 1973: iii). Icebergs, in this world of rational decision making, resource in/dependence, and parametric modeling, extended from ice shelves in the Antarctic to algorithms in a paper report. Yet this extension did not follow either an ideological or technical teleology. It reflected the evolving ways in which natural phenomena such as icebergs can be taken up into a set of social relationships that are contingent and human-made.

3D

Isaacs's idea, outside of its reconceptualization in formalized reports, incited interest in more ephemeral venues such as academic conferences. Weeks and Campbell presented an early version of their article at the Symposium on the Hydrology of Glaciers, held in September, 1969, in Cambridge, England (Weeks & Campbell 1973*c*: ii). To bring the idea home to the participants, Weeks described irrigating an area of 1,300 square miles for an entire year with a piece of ice the size of the London airport and, in his comparison, twice as high as the six-hundred-and-twenty-foot Post Office Tower (Behrman & Isaacs 1992: 51). Images such as these helped capture the imaginations of fellow scientists and engineers.

Later in the 1970s, Georges Mougin, a French engineer, undertook a series of modeling experiments of his own to test the economic and physical feasibility of towing an Antarctic iceberg to Saudi Arabia. Mougin became part of Iceberg Transport International (ITI) Ltd, which was backed and founded by Prince Mohammad Al-Faisal, the nephew of King Khalid of Saudi Arabia and the person, at the time, in charge of its water desalination program (Iowa State University, n.d.). Beginning in 1977, ITI convened a series of conferences at Iowa State University in order to seriously address the testing of potential materials and scientific scenarios that could assure the timely and cost-efficient transportation of icebergs across the Atlantic and beyond. The first, held in Ames, Iowa, was financed by Al-Faisal and the National Science Foundation. Isaacs was invited to attend, but could not due to prior obligations. Weeks spoke at this first conference and, like Isaacs later, voiced his concerns that anyone trying to move an unwrapped berg from Antarctica to the Arabian Peninsula "would end up with nothing but a towline" (Behrman & Isaacs 1992: 52). Hult and Ostrander also presented a paper at the conference. Its proceedings were published the following year as *Iceberg Utilization. Proceedings of the First Annual Conference and Workshops on Iceberg Utilization for Fresh Water Production, Weather Modification, and Other Applications, held at Iowa State University, Ames, Iowa, USA, October 2–6, 1977*. The proceedings were edited by A.A. Husseiny, an associate professor of nuclear engineering at Iowa State, and a personal friend of Prince Al-Faisal (which helps to explain the conference's location).

As ITI began its simulation work on actual icebergs, interest in the project gradually dropped off, particularly on the part of the Saudi Arabian government, given the world price of oil in the early 1980s. Mougin had to wait nearly thirty years to relaunch the project. In 2009 the French software design and simulation technology company Dassault Systèmes agreed to fund an in-depth simulation of Mougin's plan, now shifted to the Northern Hemisphere, of towing a seven-million-ton iceberg from the coast of New-

foundland to the Canary Islands. Dassault, known for producing advanced product-testing software for the likes of Boeing and Toyota, was looking for ways to demonstrate the utility of simulation technologies to scientists and engineers grappling with issues of broader public interest. The company took on Mougin's project as part of its "Passion for Innovation" program, which entailed Dassault donating the labour of engineers and use of their sophisticated software applications and simulation hardware. The results of the collaboration have been disseminated via Dassault's website, which rechristens the project "icedream" (Dassault Systèmes n.d.*a*); a 2010 documentary film, *The Iceberg Project*, directed by Jean-Michel Carillon; and, finally, a new company, Water and Power from Icebergs, and its website, managed by Mougin himself. The ultimate aim is to prove the feasibility of the project, and through this process secure external funding, whether governmental or from the private sector, to ensure that it comes to fruition.

Documentation of the project, other than that produced by Dassault and Mougin, is scarce. Soon after the completion of the simulated towing operation, it garnered press coverage from such techno-utopian publications as *Fast Company* (Sax 2011) and *Wired* (Brown 2011), as well as broader circulation in *Time* (Grose 2011) and *The Atlantic* (Madrigal 2011). The tightly controlled "product" of the collaboration signals the software-derived and intellectual copyright issues at stake. Using its patented CATIA 3D computer-aided design software, Dassault created a parametric model of the towing that incorporated data from a year's worth of remote sensing, from ocean currents and temperatures, to wind speeds and direction, and storm patterns, as well as other meteorological events. CATIA is typically used for Dassault's systems engineering projects, but here, along with its Dymola (Dynamic Modeling Laboratory) software, it was deployed in order to capture the complex series of phenomena and controllable variables (such as the hydrological layer wrapping the berg, the speed of the tug, its chosen navigation route, and so on) that the towing entailed (Dassault Systèmes n.d.*b*). The group of engineers at Dassault was joined by select oceanographers, meteorologists, and glaciologists invited by Mougin. Amongst them was Peter Wadhams, a professor of ocean physics at Cambridge University, and a long-term advocate of Mougin's plan (Wadhams 1990).

The Iceberg Project presents the fast-paced world of digital simulation and virtual reality at Dassault as being on the cutting edge of technical possibility. Part of Dassault's donation to the project also includes "the power of 3D simulation" (Kwanza-Dassault & Carillon 2010), with the ultimate virtual reality of the towing that they created serving as not only a testing ground for its limits, but also as an exercise in concrete visualization and experiential availability. The documentary depicts Mougin, the Dassault engi-

neers, and Wadhams all immersed in this virtual environment of the iceberg on the North Atlantic. With virtual reality goggles affixed, they talk into the camera about the ways in which this digital world can be "experienced" and how the models of icebergs from the 1970s now seem like outdated precursors. Clearly, authority over icebergs is directly proportional to the capacity to accurately represent them for the purposes of commodification and use.

As an *Engineering and Technology Magazine* profile of the towing project emphasizes, the principal advantages of the simulation technology were its elimination of high research and development costs if the tests had involved actual icebergs; the mitigation of human and ecological risks; and finally and most importantly, the ability to repeat the towing, again and again, with a range of logistical and operational outcomes (Harris 2011). It also allowed for a high degree of precision in calculating the melt rate of the iceberg and the efficiency of the insulation system. The conclusion of the simulated tests, an integrated drift model, makes the data-driven claim that a single tug, departing the coast of Newfoundland around the middle of June, could tow the seven-million-ton tabular iceberg to the Canary Islands in one hundred and forty-one days with minimal melting. The drift model is the synthesis of the project, incorporating all the data sets into a single parametric model. The 3D simulations presented in the documentary are not a necessary part of the calculability of the towing. Rather, they allow for this "immersive" and, one assumes, convincing quality of the idea to take shape—a quality of particular relevance for potential investors.

While Mougin and Dassault's simulated towing seemingly looks to the future, its oceanographic and meteorological data is derived from the very near past. As such, the repetitions and adjusting of parameters involved rely on historical environmental conditions. It is tempting to compare these digital environments to recent efforts to engage with environmental pasts through computer-aided means. Consider Stanford University's "Spatial History Project," or the Network in Canadian History and Environment's "GeoSpatial Historian" initiative, or the well-publicized "Mannahatta/Welikia" project supported by the Wildlife Conservation Society, which all differ substantially in how they approach, document, and analyze the past through a sense of spatiality that is subsequently represented through digital means. They nonetheless share the common concern of excavating and recreating past environments in order to establish a historical-environmental continuum that adds depth to our understandings of the ecological present. By way of contrast, the environments created by Dassault might profitably be placed in conversation with the longer history of iceberg transport and modeling, through a more science and technology studies-derived approach that addresses these environments from the generative side of their produc-

tion—that is, from within their diverse points of origins across labs, virtual reality theatres, software algorithms, and screens.

For the case of Dassault and the parametric modeling of iceberg towing, this entails documenting how this environment has emerged and what uses it is being put towards. Without falling into the trap of "screen essentialism" (Kirschenbaum 2008: 27), we should rather look to the processes of data capture and such infrastructural interfaces as satellites, buoys, balloons, and other remote sensors that inform the "environment" appearing in these models. Add to this the "supplementary" role that the virtual reality of the tow plays, and it can be seen that this digitally-rendered environment is defined by its phenomenal inputs. To historicize the digital through the lens of the environmental is to privilege the interfaces that capture phenomenal data, thus pushing such infrastructural technologies as satellites to the fore. In this equation of "environments," made evident by the importance of repetition and variation implied by parametric modeling, the work of documenting environmental change leads to a tension between the past uses of and approaches to icebergs and their future iterations of possible, calculable use.

Conclusion

Thinking about the politics of calculation brings to mind Isaacs's means of convincing Americans of the 1960s, and southern Californians in particular, of the reasonable cost of icebergs as a source of water provision. With complaints rampant as to the cost of desalinated water, Isaacs worked out the cost per acre-foot of that society's crucial liquids: beer and coffee, $800,000; bar whiskey, $20 million; Chanel No. 5, $40 million (Behrman & Isaacs 1992: 55). The construction of an iceberg as a commodity was intimately linked to its representation as a controllable object. Today, icebergs seem again to be on precisely this cusp between public interest and private control, between often ecologically short-sighted policy-led development and the sometimes far-sighted optics of corporate profit-seeking.

For Northern environmental historians, thinking of ice as a generative social relationship at large is a fruitful endeavour. Making ice available and claiming it as an emergent resource would seem to be an exclusively human practice, and thus one subject to processes of semiosis. Yet this practice relies on all the methods of visualization I outlined above. Besides being media environments in their own right, these methods also make icebergs an iteratively quantifiable, representable, and commodifiable phenomenon that we come to know through its various representational strategies. Does it help or hinder Dassault and Mougin's case that these are North Atlantic icebergs, tinged by Titanic-histories of human interaction, rather than Ant-

arctic ice islands, without human-derived markers of occupation and use? In part, this is an (environmental) historian's question to answer, especially when it comes to thinking about what role historical narratives can play in influencing governmental policies and their own shaping of resource use and demand (Sabin 2010).

Early on in the proceedings of the First International Conference on Iceberg Utilization at Iowa State University in 1977, the glaciologist Henri Bader noted that given the lack of government interest in iceberg transportation schemes in the early 1970s, "[t]he idea seemed destined for early filing in the archives" (Frazier 1977: 299). And yet the question "Is there an iceberg in your future?"—which served as the title of the *Science News* profile of the event—has been amenable to reinterpretation and appropriation well beyond its heyday in the late 1970s. It resonates in the present, given our awareness of global warming and its production of various incarnations of ice as increasingly akin to an "endangered species" (Carey 2007: 500). As such, if there is indeed an iceberg in our inevitably common environmental future, the open question remains as to by what means, and perhaps by what media, we will come to know it.

NOTES

[1] At the time of writing, a list of such emerging media environments could include the ice wall being built by Tepco, the operator of the Fukushima nuclear power plant, to contain its radioactive reactors (BBC 2014), and NASA's Operation IceBridge, a project that seeks to map out in greater detail the bedrock beneath the Antarctic ice sheet (NASA 2013).

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