Arctic ice edge narratives: scale, discourse and ontological security

Siri Veland and Amanda H Lynch

Institute at Brown for Environment and Society, Brown University, Providence, RI 02902, USA

Email: siri_veland@brown.edu

The Arctic ice edge centres deliberations over the region's futures, either as an explicit policy and research problem, or as an implicit control on innovations. This exploratory paper proposes a narrative approach to examine ontological security, identifying a common epistemic structure in multiple ways of knowing the ice edge, and of devising associated policy. These epistemic narratives weave discourse (ideas, concepts and knowledge) and scale (as relationships, networks and timelines) to provide coordinate systems of purpose and identity that unfold as the material world. Surreptitious, un-narrated or interfering changes can produce ontological insecurities, often leading to closed decisions in authoritarian forums. Research and policy designed for complexity anticipate ontological insecurities through democratic and deliberative narratives of earth system processes.

Key words: Arctic, ice edge, narrative, scale, discourse, ontological security

Introduction

We tend to understand the world in ways that permit observing, naming and contextualising phenomena logically. Anthony Giddens argues this sense-making maintains ontological security – the assumption that observed elements and processes will continue to support existing identity and belonging. The schema for such security, this paper argues, is a basic narrative structure that identifies phenomena, gives them proper context and situates our place in them. Supporting this view, Polkinghorne (1988) recognises narrative as a most fundamental means of rendering human existence meaningful. Summarising cognitive and social science research on narrative, Paschen and Ison (2014, 1083) show 'human cognition is organized around specific narrative structures'. Story-telling, Rose (2004) shows, weaves space and time, giving a sense of who we are by narrating what is ahead of us, what is behind us and what connects us.

At the Arctic ice edge, a multitude of story-lines intersect, drawing on a diversity of histories, identities, methodologies, perspectives on risk, and hopes and visions for the future (Bravo 2010). An icon of climate change, a frontier of shipping and petroleum industries, and the home of Indigenous peoples, their story-lines connect in discursive and material ways with places remote from the Arctic. For a long time, a remote region in its own right, the Arctic now repositions as centre of geopolitical deliberations between Arctic nations, Arctic residents, and their lower latitude and southern hemisphere networks. Social and material relationships engaged in debates over Arctic futures include the local to national level Arctic jurisdictions, Tribal governance, the Arctic Council, the United Nation Law of the Seas (UNCLOS); the financial resources of corporations, nongovernmental organisations and researchers; the atmospheric circulations of greenhouse gases, black carbon and low pressure systems; the ocean currents of changing ice floe, temperatures, salinity, acidity and seasonal migrations of marine animals; the circulation of petroleum into the powering of societies across the world. Narrating the ice edge, through pictures, policy papers, speeches, cost-benefit analyses and engineering schematics, their authors work to engage material networks according to the key roles they ascribe people, processes and ideas, at the temporal and spatial scales they consider appropriate. Mol (1999) warns drawing on diverse approaches for diagnosing conditions cannot aggregate understanding, but rather contributes different ways of 'performing' them. Similarly, diverse ice-edge narratives cannot produce an increasingly complete

picture of the Arctic, but partake in an *agential realism* (Barad 2007), where narrators and their story-lines define this place, attending to the particular material and governance scales they favour, and in turn compete, juxtapose and subsume the narratives of others. Surreptitious and unplanned changes challenge story-lines about what this region is, and the direction and significance of its changes. Where ontology proves insecure, rendering meaning, identity and value uncertain, Ulrich Beck argues, people increasingly lean on established and fundamentalist narratives. This risk is found in the need to solve 'wicked problems' (Rittel and Weber 1973) such as climate change. Indeed, some have argued there is a 'race for the north', or a 'new cold war' in the Arctic. Carefully storying the Arctic as a place of collaboration and new governance, Young (2011) cautions that such narratives are greatly exaggerated. Rather, Kämpf and Haley (2014) diagnose the problem as a labyrinthine policy process of intersecting values and jurisdictions, forcing a grid-locked decision process that is also governed by the changing ice edge itself.

The two central motivations for writing this paper are to (i) contribute to debates on ontological security, by (ii) considering research and policy concerning industries in the thawing Arctic. We first propose a framework of narrative materiality for understanding ontological security, and apply that to on-going knowledge production. We suggest five modalities emerging from closed to democratic-scaled material networks, in deliberative to authoritative discourses, and consider some implications for research and policy concerning the retreating Arctic ice edges, urging the need for open, reflexive and adaptive decision forums.

Narrative materiality

Story-lines have inertia, where the next step, the next decision, emerges from what has gone before, following a 'plurality of trajectories' making up 'a simultaneity of "stories so far"' (Massey 2005, 12). 'The latest scientific research', Barad argues, 'strongly suggests a fundamental inseparability of epistemological, ontological, and ethical considerations' (2007, 25). Storying is methodology. Presenting *narrative theory*, Paschen and Ison (2014) argue the narrative is an epistemological frame, and base narrative theory on two premises. First, in the metanarrative sense that human 'experience, cognition and values are organized around culturally specific plots and archetypical narrative structures' (2014, 1086). Second, attending to the epistemic nature of narrative, where 'relating an experience through story-telling is already doing 'knowledge work', or learning, through the reflective reworking and developing of knowledge content' (2014, 1086). This is reflected in narrative's

Latin root, where *narrare* means to know, an insight also gleaned from physics. In *Meeting the universe halfway*, Barad (2007) builds on physicist Niels Bohr's ideas of discursive epistemologies in quantum theory to argue for an *agential realism* by which discursive constructs are lively entanglements in materiality, resting on complementarity between discourse, method and ontological determination (Barad 2007).

Narratives are often considered purposive and directive, deliberate framings of events in order to pursue a particular aim (cf. Jones *et al.* 2014), but their role in life histories (Polkinghorne 1988; Goodson 2012), policy (Roe 1994; Fischer 2003) and more fundamentally as epistemology (Bawaka *et al.* 2015a; Haraway 1988; Paschen and Ison 2014) imply an innate and only partially voluntary sense underlying purposive narratives. The grand narratives Doremus (2000) outlines, for instance, can be found in policy. Her 'wilderness myth' can be found in National Parks Policy, the 'Noah's Arc myth' in the Endangered Species Act and the 'ecological horror story' in Environmental Impact Assessments.

Works written with Indigenous Australians are particularly instructive in showing this agential realism in space-time. Fisher *et al.* say 'they have had to let go of questions such as: "so when did this really happen?" and accept multiple truths and ambiguous time scales' (2015, 30). Bawaka *et al.* (2015a 2015b) show storying as co-becoming space/place. Verran (2004) shows Kantian noumena are not recognised; phenomena can only be defined in their temporal context through the movement of the story. Cruikshank observes that

> narratives are better understood by absorbing the successive personal messages revealed to listeners in repeated tellings than by trying to analyse and publicly explain their meanings. (2005, 60)

Cruikshank (1990) also shows the at first bewildering complexity of plots and characters in the narratives of Yukon women proved to be a kind of triangulation, where each narrative fragment explains certain aspects of their life stories. Temporal and spatial scales, invoked through the phenomena narrated, are methods of inquiry that contain the materials of culture. Ignoring the materiality of such narratives in policy and research constitutes deep colonising, where cultural erasure and social injustice perpetuates despite emancipating aims.

Narrative approaches put forward by Said (1993), Adger *et al.* (2001), Bankoff (2001), Rose (2004) and Cruikshank (1990 2005) facilitate self-reflection necessary to discover the epistemology of narratives. Myths fill gaps in understanding, implicitly staging desired outcomes and alternatives. Rose warns of an epistemological trap

in which the self mistakes its reflection for the world, sees its own reflections endlessly, talks endlessly to itself, and, not surprisingly, finds continual verification of itself and its worldview. (2004, 20)

In this vein, Doxiadis and Mazur examine mathematics and narrative as representing two worlds, where narratives are 'stories representing the way we act and interact', and mathematics 'giving us pure thought, distilled from the hustle and bustle of reality' (2012, xii). They therefore apply a physics-based analysis to narratives, but fail to do the reverse, treating mathematics as 'other'. Critiquing such tendency, Massey observes, 'narratives, stories, trajectories are all suppressed in the emergence of science in the writing of the world' (2005, 25). The following sections outline narrative as constructing spatial and temporal scales through attention to events and processes, through four key considerations:

- What is the discourse (knowledge concepts, ideas)?
- What scales (relationships, networks, timelines) are emphasised?
- How do the narratives weave discourses and scales (who, what, how, when)?
- How might system reflexivities (un-narrated, interfering, parallel, surreptitious change) unsettle ontological security?

Ice-edge narratives

The following sections illustrate the role of discourse, scale and narratives in shaping interactions with the ice edge.

Definitions

The ice edge is the border between the polar ice caps and the open ocean, a definition qualified by myriad voices (Table 1). The National Ice Center recognises this edge as a diffuse and dynamic area where ice covers 15 per cent or more of the surface. The Norwegian Integrated Management Plan for Lofoten-Barents Sea considers the ice edge a border for industrial activity, due to engineering challenges and vulnerable biodiversity. Polar bears, seals, whales and Arctic Cod are dependent on the ice edge for feeding and reproduction. Inuit follow the ice edge to hunt, constituting a critical component of Inuit cultures and livelihoods. Many Inuit join petroleum corporations in considering the ice edge as a technological challenge requiring engineering for drilling and spill clean-up. Climate change mitigation advocates consider the retreating ice edge a symbol of rapid environmental change. But what *is* the ice edge? Are any of these prior to others? Do they add up to form a more complete

image of the ice edge? Bravo (2010) summarises *SIKU: knowing our ice*, urging that the social ontology of sea ice must be recognised in policy and research. Mol (1999) warns that the self cannot recognise that it makes decisions about the nature of things – its 'performance' of them – akin to Massey's (2005) 'space-time-mattering', Barad's (2007) agential realism, Bawaka et al.'s (2015a) co-becoming, or indeed to Niels Bohr's complementarity principle. Words, concepts, definitions, provide a triangulation of place, but not the place itself.

Scales

Temporal and spatial dimensions of the ice edge scale in myriad ways (Table 1). Across the Arctic, Indigenous Nations nurture millennial relationships with the ice, drawing on individual-to-cosmological relationships with its annual cycles. Ice cores provide a millennial-scale record of sea ice presence, while observational records from fishing, whaling and sealing ships reach back several hundred years. Buoys provide maps of sea-ice extent since the 1960s, supplemented by satellite data since the 1980s. These data support physical model simulations of yearly-decadal sea-ice extent and movement, and statistical models of daily to weekly ice presence and characteristics. The spatial extent of the Arctic ice edge varies annually, reaching a minimum in September and a maximum in April. The annual maximum has retreated markedly over the last decade, although with high inter-annual variation. In turn, Arctic governance scales the ice edge varyingly. In Norwegian national legislation, the ice edge represents a national spatial-temporal boundary for industry, while in United States policy, industrial activities falls under Federal, State and Borough jurisdictions, depending seasonal location. Increased geopolitical attention causes UNCLOS to reconsider the legal framework of the ice edge under Article 234 and associated international interests, while the IMO is working to update the Polar Code for shipping. Industries, in turn, scale the ice edge according to time needed for return on investments, calculated by discount rates and time required for innovating ice-resistant technologies. Scales such as the local, regional or global – and equally immediate, past, future and present – represent particular ways of attending to material relationships (Howitt 1998; Swyngedouw 2004; Massey 2005). Exercising scale is exercising power, directing the flow of resources through spatial-temporal networks.

Narratives

Greenpeace imagery of underweight polar bears swimming in the open sea or clinging to a small piece of floating ice are narrative fragments of metanarratives

Table 1 Select policy bodies and their definitions of the Arctic ice edge

Policymaking body	Definition	Spatial scale	Temporal scale	Associated activity
IMO	1/10 ice coverage shore fast ice 2/10 ice coverage special training	Arctic waters	Multi-decadal	Determining requirements for Category A, B or C ships
Inupiaq cultures	Where ice meets open water. sin ‾ a', sinaaq, kinniq	North American Arctic and Greenland	Cosmological	Subsistence
Ministry of Climate and Environment Barents Sea Management Plan	15% ice cover as delimited by the Norwegian Polar Council	Norwegian Exclusive Economic Zone	1985–2014, average for 1 September	Industry, particularly petroleum, conservation
UNCLOS	Presence of ice (ambiguous)	International and national waters	Multi-decadal	Industry, conservation, Indigenous activities
Interior Department's Bureau of Safety and Environmental Enforcement	Five-year historical average of earliest sea ice encroachment	United States Arctic	38 days before 1 November	All industry
Proposed Arctic Drilling Rule	Presence of sea ice (ambiguous)		Continuous forecasting and reporting	
Industry ice management strategy	Ice accretion, encroachment and presence	Operations site	Over project operations	All industry
United States Federal Government	Dependent on Agency definition	United States Exclusive Economic Zone	Multi-decadal	All within United States territories

urging combat against destructive human policies. Rosneft and Exxon's illustration of an envisioned ice-capable oil rig constitutes a narrative fragment of metanarratives generating engineering capacity, human ingenuity and economic prospects in the Arctic. The 2013 United States Arctic Strategy report opens with concern for climate change, and casts security, stewardship and international collaboration as key components of its spatial-temporal 'coordinates' for intended ways toward Arctic development.

Physical models of ice behaviour also follow basic narrative form: scientists construct story-lines from the concepts and relationships of physics when defining and relating relevant components, using metaphors in the form of numerical constants and variables called 'regularisation' to describe interactions. Metaphors for ice rheology include 'viscous-plastic' (Hibler 1979), a 'cavitating fluid' (Flato and Hibler 1992) and an 'elastic-viscous-plastic' (Hunke and Dukowicz 1997) (Equation 1). Scales of albedos, or reflectivities, represent ridges, ponds, brine pockets, cracks, algae, soot or old snow in the observed ice. Scaling these variables maximises

computational power. Modellers then test the materiality of their narrative of system components against a 'plot', or event, that has been observed and recorded.

$$\frac{1}{E}\frac{\partial \sigma_{ij}}{\partial t} + \frac{1}{2\eta}\sigma_{ij} + \frac{\eta - \zeta}{4\eta\zeta}\sigma_{kk}\delta_{ij} + \frac{P}{4\zeta}\delta_{ij} = \dot{\epsilon}_{ij} \qquad (1)$$

Equation 1: Rheology - relationship between stress (σ_{ij}) and strain rate ($\dot{\epsilon}_{ij}$) - for an elastic-viscous-plastic material expressed in tensor notation, where η. is the shear viscosity, ζ is the bulk viscosity, E is Young's modulus of elasticity, P is the pressure, and δ_{ij} is the Kronecker delta.

Statistical model narratives differ from the physical models above, casting the future by projecting the trends of statistical data on sea-ice thickness and movement, achieving two- to three-week accuracy, depending on spatial scales. Policymakers and industry rely on statistical narratives. Until January 2015, the Norwegian Polar Institute based the 15 per cent boundary of ice cover on observations from 1967 to 1985. Updating their statistical models to include satellite data from

1985 to 2014, they adjusted the location of the ice edge, and associated industry, northward.

Ontological security

Narratives entraining Shell's exploration in the Chukchi Sea proved insecure as the oil rig Kulluk stranded in December 2012. Tether strength calculations, storms and ice forecasting, ability to refurbish a 30-year-old drill rig and urgency to avoid incurring additional fees, all failed to engage with the surreptitious and unforeseen changes near the Chukchi Sea ice edge. The stranding was a failed invocation of political, economic and engineering narratives of ice-edge industry. The North Slope Village of Kaktovik speaks of the challenges of invoking foreign narratives of the Arctic, lamenting capacity deficits of non-Indigenous decisionmakers (Howitt *et al*. 2013), and warning of

> fundamental conceptual problems, incomprehension, and misinterpretation of northern landforms and landform processes; mapmakers mired in mid-latitude thinking, as their ancestors were in sea monsters at the edge of the world, showing things that are not there, and not showing things that are. (People of Kaktovik 2003, 1)

Ontological insecurity affects statistical and physical models of ice behaviour. Statistical models cannot project novel behaviour, such as northward retreat. Walsh *et al*. note that, for physical models,

> the levels of uncertainty and inter-model divergences with increasing time-spans and levels of complexity should be troubling for any decision-maker who has to plan for the future based on such data. (2011, 20)

They remind the reader that physical models, 'are not "truth-machines", but general guideposts'.

Policy bodies define and scale the ice edge depending on jurisdictional narratives of causality, often narrated as an abstract and diffuse region (Table 1). Recent research on Arctic policy, for instance *Polar geopolitics?* (Powell and Dodds 2014) and *Diplomacy on ice* (Pincus *et al*. 2015), as well as Young (1998) *Creating regimes: Arctic accords and international governance*, are contrapuntal to ice-edge dynamics, but the volumes mention 'ice' mostly in vague terms such as thinning, disappearing and melting – low-resolution biogeophysical trends writ into shorter term policy narratives. Understanding and managing shorter term and smaller scale variability and associated risks are relegated to industry subsidiaries (e.g. of Shell logistics) and government departments (e.g. BEES, the Coast Guard). Indigenous and ancestral policies, richly described in *SIKU: knowing our ice* (Krupnik *et al*.

2010), account circumpolar Indigenous performance of the ice edge, but outside the cannons of nation-state geopolitics and science.

Narratives, as described above, invoke ontological security in two senses. First, in the Giddensian sense of sustaining identity and belonging; and second, in a positivist sense of relying on knowledge to be 'secure' – i.e. that the concepts and material networks humans rely on are 'really real', independent of our subjective experience of them. Liverman (2009) identifies problematics of ontological security as she argues the ideas and scales invoked in climate change adaptation narratives surreptitiously establish a new set of north–south relations. When complex challenges cannot be tackled using the resources (concepts and networks) available, people may rationalise a status quo, relying on existing identity markers to sustain a sense of ontological security (Norgaard 2006). Do Alaskan decisionmakers and Shell executives rely on a similar sense of ontological security in insisting on drilling? Do environmentalists, when insisting on banning Arctic drilling? Beck (2009) warns ontological insecurity can lead to increasing insistence on having the 'right' knowledge and connections, insisting on a particular narrative, while violently marginalising others. It is in the intersections of diverse onto-epistemic narratives, where the ontology of ice-edge knowledge is juxtaposed and fragmented, that the challenge and opportunity for sustainability lies.

Decision processes

The degree to which onto-epistemic narratives engage diverse ideas and networks can be imagined as a set of scenarios (Figure 1). We consider discourse as a continuum from authoritarian and expert-driven knowledge base to deliberative discourse that tolerates varying perspectives. We consider scaled material networks as extending from closed and limited, relying on a pre-determined and constrained set of social and material relationships, to a democratic network that accepts relational ontologies (Howitt and Suchet-Pearson 2006) where ideas, processes, roles and connections co-emerge with the connections that permit their resolution. Between these continua, five modalities describe how discourses and networks combine in decision forums. For each modality, system reflexivities hamper the ability to tell accurate stories of causation, but to different degrees they ignore or work with the causes and manifestations of ontological insecurities.

The dictatorship

A selective attention to authoritarian narratives ignores key perspectives and processes. This is equally possible
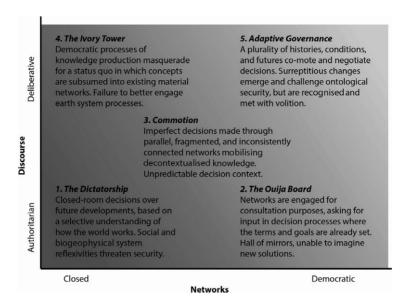
**Figure 1   Scenarios based on the degree to which knowledge concepts and material networks
are integrated in decisionmaking**

for environmentalists who boycott deliberative decisionmaking over sustainable development, as for politicians who leverage their economic and technological networks, for local communities that ignore global calls for a phasing out of fossil fuel production, or for nations bent on taking control of resources in other territories. This modality is the trap of ontological insecurity described by Ulrich Beck (2009), where the dissolving of ontological security can lead to fundamentalism.

The ouija board[1]
Extensive social and material networks engaged here masquerade for a fact-based and democratic decision-process where 'the greater good' invisibly steers developments. They risk instead facilitating a setting in which the power of key players is obscured. The decision process is open to the presence of all stakeholders, but the stage is set for the mobilisation of dominant and privileged paradigms of power.

Commotion
The North Slope of Alaska is a heavily researched region. 'Research fatigue' is caused partly by complexly overlapping jurisdictions. A multitude of ongoing consultative events without coordination and staged workshops entertain a diversity of people and places, but the knowledge base does not engage social or biogeophysical relationships effectively. For example, the People of Kaktovik (2003) express concern that

while they are invited by a host of industrial, research, activist and government interests to comment on a host of issues, their insights are fragmented and lost in highly porous and poorly connected relationships. This is the state Muller (2014) describes as 'commotion', where different ontologies come together in messy and unproductive ways.

The ivory tower
In this modality, new ideas, concepts and worldviews emerge, but fail to engage wider social and biogeophysical networks, a risk in academic research, engineering and global or regional governance. Individuals and groups mobilise new concepts and ideas, and national and sectorial representatives collaborate on governance, such the Arctic Council and United Nations, but do not mobilise social and material relationships. It is in this modality that the ideas of sustainability, resilience, vulnerability and perhaps the new idea of transformation are co-opted into the status quo.

Adaptive governance
This modality acknowledges ontological insecurities and draws on new and innovative decision processes that mobilise new relationships, acknowledging surreptitious social, environmental and geopolitical processes incorporating them into policy (Brunner and Lynch 2010). Ideally, this process of adaptive governance includes global networks and knowledge, akin to that described by Dryzek (2006), promoting co-motion as

described by Muller (2014). Democratic and deliberative process is the imperfect but necessary antidote to ontological insecurity, and works best when anchored in the values, rights and priorities of those living in place.

Discussion

Ontological insecurity is an insurmountable challenge for environmental decisionmaking. The nature of knowledge production is such that we only have probabilities, no truly factual observations to avoid risks as industry moves into proximity with the ice edge. Yet these insecurities are compounded if enabling a decision process in which people, processes, ideas and relationships are ignored. This leads to policies with lack of public support, or in defiance of known biogeophysical risks. For instance, the complex Alaskan governance structures, involving intersecting and overlapping interests, values and authorities of actors both between and within Federal, State, local, Tribal, industry and NGOs, produce a labyrinthine decision process (Kämpf and Haley 2014). This observation points to a trajectory in which a poorly integrated network of actors invokes a plurality of discourses, producing a clouded decision process. There is a real danger that ontological insecurities will lead to closed decisions in authoritarian forums (Beck 2009). The likelihood of such futures is reduced when open deliberative processes incorporating a variety of story-lines about what the Arctic is, and what people can or should do there (Cameron 2012). This will not eliminate the possibility for error, but will address procedural vulnerabilities (Veland *et al.* 2013) and address processes of deep colonising (Rose 2004).

The recent Papal Encyclical (Francis 2015) argues that we cannot renew our relationship with nature without renewing our relationship with each other. His recognition is that the 'natural' world is created by, through and with the same human concepts, ideas and emotions that create the 'social'. Recognition is urgently needed that the way in which we story the world matters. Narratives about who we are, where we live and what we do are epistemic, and produce ontologies that to different degrees engage material networks (as the chemistry of emotional responses, the welding of materials, the connection of cultures, the signing of corporate contracts, the making of paths through a forest). The perception that the stories we live provide security in the continuation of identity and meaning produces human actions that follow specific narratives despite evidence of surreptitious and unaccounted-for processes undermining this security. The Anthropocene narrative warns that these stories – the concepts and networks that make them – must change.

In cross-cultural contexts, attention to lived ontologies and epistemologies is critical, because it is the most taken-for-granted behaviours and practices that perpetuate research within the 'hall of mirrors' (Rose 2004), in which the observers see only their own ontology reflected in the world around them. The sheer amount of data and on-going information-gathering about the ice edge and human activities there creates a bewildering decision-context that appears overwhelmed by insecurities (Kämpf and Haley 2014). As in scenario two (Figure 1), the result is an erratic decision process in which actors take excessive risks. For industry and environmental activists alike, this might appear as a form of 'distraction by data collection'. Without attention to the ways in which developments follow a path dependence, there is a risk that developments turn toward either scenario two or four, in which the commotion fails to result in co-motion (Muller 2014), and meetings and knowledge generation masquerade for a status quo. Moving toward co-motion, Cruikshank (2005), Krupnik *et al.* (2010) and Huntington (2011) urge efforts to continue to nurture the role of Indigenous knowledge in research and policy.

Conclusions

No onto-epistemic narrative can lay claim to 'being' the ice edge, but simply different means of identifying and therefore constructing this place. Ontological security is here both an outcome and a driver. The concepts and networks humans live by are all that is known, the very making of metaphysics, and also therefore the episteme by which we generate new knowledge. The limits of epistemologies are that they never produce truth, but rather possibilities for truth. Simplifying the wickedly complex decision context concerning human activities at the ice edge might 'feel' ontologically secure, but this observation warns that no single story-line accounts for the truth of this place, that all decisions will produce risk and fall short of producing secure ontologies. Relying on particular narratives of causation, because they provide methodological comfort and a subjective sense of security that the world unfolds according to our expectations, risks missing important processes, inciting surreptitious, unforeseen and even malicious reactions. Of course, the current paper seeks its own ontological security, seeking truths that can transcend contexts. As Barad (2007) observes, we are always trapped inside the system we are trying to describe.

Pre-conditioned claims to knowledge or connections that ignore and marginalise alternative perspectives compound the uncertainties of science and perspectives on risk. This threatens the outcome of the decision

making process by invoking resistance and ignoring surreptitious change. Basing policy scenarios on the modalities of the narrative materiality presented in this paper will attend to the inherent structure of knowledge-making, and promote open and deliberative processes that acknowledge and work with ontological insecurities.

Acknowledgements

Note

1 A Ouija board has alphabetical characters along its edges. Game participants keep a finger on an object that passes between the letters, spelling out a phrase.

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